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UNITED STATES DEPARTMENT OF AGRICULTURE
BULLETIN No. 631
Contribution from the Bureau of Animal Industry
JOHN R. MOHLER, Chief

Washington, D. C. ▼ April 19, 1918

FIVE YEARS' CALF-FEEDING WORK IN ALABAMA AND MISSISSIPPI

By
W. F. WARD and S. S. JERDAN
Of the Animal Husbandry Division

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I. WINTER FATTENING OF CALVES ON COTTONSEED MEAL, COTTONSEED HULLS, CORN-AND-COB MEAL, AND ALFALFA HAY.

PREVIOUS EXPERIMENTS.

During the winter of 1910–11 (November 17 to March 17) this bureau, working in cooperation with the Alabama Experiment Station, carried on an experiment in fattening calves on various rations. These results are published in Bulletin 147 of the Bureau of Animal Industry and in Bulletin 158 of the Alabama Experiment Station. The first lot of calves was fattened on a ration of cottonseed meal, hulls, and alfalfa hay. The second lot was given a one-third ration of corn-and-cob meal in conjunction with the cottonseed meal, hulls, and hay. The third lot was given a liberal allowance of corn-and-cob meal and a rather small allowance of cottonseed meal, the corn-and-cob meal constituting two-thirds of the concentrated part of the ration. As the work reported in the present bulletin is really a duplication of that previously reported, it will be of interest to introduce the discussion with a short extract from the above-mentioned publication, especially since the two years' work do not agree in all particulars. In the discussion following the financial statement, it was stated that all the calves were fed at a profit (the calves were bought at $3.50 a hundred pounds and sold for $5.01, $5.11, and $5.26, respectively, in lots 1, 2, and 3), the lowest being $1.48 per calf in lot 3 and the highest $2.25 per calf in lot 2. These profits meant that the corn and the hay raised on the farm were sold, through the calves, at 70 cents a bushel and $15 a ton, respectively; that the money expended for cottonseed meal and hulls was all returned to the owner; that the fertilizer value of these feeds was left on the farm, and, in addition, each calf returned the above additional profits. The monetary returns were satisfactory, as by means of the calves the farm feeds were sold for more than could have been secured for them on the market, and their fertilizing value was left on the farm in the shape of barnyard manure.

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[1] This work was done in cooperation with the Alabama Experiment Station, J. F. Duggar, director, and the Mississippi Experiment Station, E. R. Lloyd, director. G. A. Scott, of the Animal Husbandry Division, U. S. Department of Agriculture, assisted in preparing computations.

The calves in lot 3, which received the heavy ration of corn-and-cob meal, returned the smallest profit, notwithstanding the fact that they sold for the highest price at Cincinnati. The increase in the price did not overcome the added expense of feeding a heavy ration of corn-and-cob meal. Although it did not pay to feed the heavy ration of corn-and-cob meal, it did pay to feed the small amount of corn-and-cob meal that was used in lot 2, as the calves in this lot proved to be the most profitable. This indicates that when fattening beef calves with cottonseed meal and corn-and-cob meal as the concentrates one-third of the concentrated part of the ration can consist profitably of corn-and-cob meal, but it is less profitable to have corn-and-cob meal constitute two-thirds of the concentrated part of the ration.

However, there was one factor that had not been taken into consideration which, if considered, adds to the profits of lots 2 and 3, especially the latter. Some undigested corn passed through the calves in these two lots; hogs following them would have derived no little benefit from the droppings. In fact, several hogs did follow the steers in lot 3, but no record was kept of their gains. These gains should be credited to the calves.

In the present test, hogs followed those calves that were fed a partial ration of corn.

OBJECTS OF WORK.

As with the previous test, the main object in this calf-feeding work was to determine whether the farmer can afford to raise a good grade of beef calves and finish them for the market when they are about a year old. In the South the usual custom is to keep the offspring until they are from 2 to 4 years old before finishing them for the market. Many farmers, however, are now asking if it would not be more profitable to sell the calves while they are yet young, thus making it possible to increase the size of the breeding herd. As stated before, some results of calf-feeding work have been published; the present publication must be considered only a report of the progress of the work, as the experiments are being continued and new phases studied.

The calves in this test were divided into three lots so that a comparison of the value of certain feeds for fattening young calves could be made. The following problems were studied:

1. The calves were raised on the farm where they were fattened, and one object was to learn whether a farmer profitably can raise and fatten calves for the market by the time they are a year old.
2. To make a comparison of southern feeds and combinations of feeds that may be used for fattening calves during the winter months.

This work was carried on upon the farm of O. E. Cobb, of Sumterville, Ala., with whom the bureau and the station have been in cooperation for a number of years. Mr. Cobb furnished the calves and the feed and the Bureau of Animal Industry and the Alabama Experiment Station provided a trained man to live on the farm and have personal supervision of the experimental work. In this way all the tests were made under average farm conditions and at the same time were executed in an unusually accurate and painstaking manner. The junior author of this bulletin was stationed upon the farm and had personal supervision of the work.

KIND OF CALVES USED.

The calves used in this work were all high-grade animals. They were not, however, uniform in breed and breeding, as Hereford, Shorthorn, Aberdeen-Angus, and Red Polled blood were all represented. The calves, however, were far better than the average raised in the western part of Alabama, as they were from one-half to seven-eighths pure bred. The majority of the calves were raised on the farm where the feeding was done; however, there were not a sufficient number, so some were purchased from neighboring farmers in Sumter County. All had been born the preceding spring, so they were from 6 to 8 months of age when the fattening experiment began. During the summer they had run with their dams on good pasture, and during this time they demanded practically no attention from the owner, except to see that they were salted and dipped. Both the cows and the calves were dipped regularly all through the summer months to reduce the number of ticks.

On November 19, 1911, when the fattening period began, the calves averaged 376 pounds in weight.

GENERAL PLAN OF THE WORK.

When fall arrived and the pastures were exhausted, the calves were taken from their dams and placed in this experiment. The original intention had been to begin the winter feeding work in the fall just as soon as the pastures were exhausted and the milk flow of the dams diminished, to avoid losing any part of the calf fat, but on account of a short unavoidable delay the feeding was not begun until the above-mentioned date. In the meantime the calves doubtless lost a few pounds in weight after the pastures became short. This, of course, was unfortunate.

The calves were weighed individually on November 16 and 17, and the average of the two weights taken to determine the initial weight. The test began, therefore, on November 17, but on the day previous the calves were tagged and numbered, dehorned, the males castrated, and the whole number divided into three lots as nearly equal in size, quality, and breeding as possible. Each lot of calves was fed from November 17, 1911, to March 3, 1912, a period of 107 days, on the following feeds:

Lot 1. Cottonseed meal; cottonseed hulls; mixed alfalfa hay.

Lot 2. Cottonseed meal, two-thirds; corn-and-cob meal, one-third; cottonseed hulls; mixed alfalfa hay.

Lot 3. Cottonseed meal, one-third; corn-and-cob meal, two-thirds; cottonseed hulls; mixed alfalfa hay.

SHELTER AND LOTS.

The calves were young, so each lot was provided with shelter sufficiently good to turn the cold rains and break the cold north winds. Shelter would not have been necessary for mature steers, but the experience of former work[1] thoroughly demonstrated that young calves will not do well, even this far south, without some protection from the cold winds and rains of the winter months. Each lot of calves was confined in a ½-acre paddock and the calves had the privilege of staying either in the open lots or under the sheds. The lots were not paved. The winter of 1911–12 was unusually wet, consequently the uncovered parts of the lots became excessively muddy at times. The ground floors of the sheds were always dry, however, so the calves had comfortable and convenient places in which to lie down.

METHOD OF FEEDING AND HANDLING THE CALVES.

The calves were fed twice each day; the first feed was given about 7 o'clock in the morning, and the second at 5 o'clock in the evening. The concentrated feeds were placed in troughs, each of which was about 12 feet long and 3 feet wide. When both cottonseed meal and corn-and-cob meal were used they were mixed thoroughly with the cottonseed hulls. The hay was fed in separate hay racks. The concentrated feeds were fed in such amounts that the troughs were cleaned thoroughly within one hour after feeding, but hay was kept in the racks all the time. Both the troughs and the racks were under sheds, so that the feed never became wet and the calves had comfortable quarters in which to eat. Salt was supplied regularly, and fresh water from a deep well was supplied in clean cement troughs.

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[1] Bureau of Animal Industry Bulletin 147 and Alabama Experiment Station Bulletin 158.

As stated above, at the beginning and end of the experiment individual weights were secured on two successive days. During the course of the test the total weight of each lot was secured every 28 days.

CHARACTER AND PRICE OF FEEDS.

Cottonseed meal, corn-and-cob meal, cottonseed hulls, and mixed alfalfa hay were used in this test. The cottonseed meal and the cottonseed hulls were purchased at a local market and hauled to the farm, a distance of 9 miles. The corn for the corn-and-cob meal and the mixed alfalfa hay were grown upon the farm where the test was made. The cottonseed meal was only fair in quality. The corn was of high quality. The whole ears of corn with the shucks were run through a grinder and made into corn-and-cob meal. The hay, made of a mixture of alfalfa and Johnson grass, was bright and had been well cured, but the Johnson grass was somewhat coarse. During a part of the test, from January 10 to February 8, Johnson-grass hay alone was fed, as it was not possible to secure a supply of the mixed hay during this short period.

As stated in the first part of the bulletin, it is always unsatisfactory to render a financial statement in work of this character, as the price of the feeds, as well as of the cattle, varies considerably from time to time and from place to place. The really important data are those showing the daily gains and the amount of feed required to make 100 pounds of gain. In this test the feeds were valued as follows:

Cottonseed meal	per ton	$26.00
Cottonseed hulls	do	7.00
Corn-and-cob meal	do	20.00
Mixed alfalfa hay	do	14.00

As a matter of fact, the cottonseed meal cost only $24.50 a ton and the cottonseed hulls $7.50 a ton, but the above prices were adopted for the sake of uniformity. They represent fairly accurately the average prices of feeds in the State. The prices on the other two feeds represent exactly the market prices when the test was made.

DAILY RATIONS.

The farmer who undertakes to fatten young animals should understand that the younger the animal the greater the skill required to care for and feed it. Young calves should not be cared for and fed in a careless manner. With animals of this class one case of carelessness in overfeeding may retard very seriously the whole future development. Table 1 shows the average amount of feed eaten by each calf daily:

TABLE 1.—*Average daily rations (November 7, 1911, to March 3, 1912).*

Lot No.	Number of calves.	Ration.	Feed consumed by each calf daily.
			Pounds.
1	16	Cottonseed meal	2.16
		Cottonseed hulls	10.26
		Mixed alfalfa hay	4.31
2	15	Cottonseed meal, two-thirds	2.01
		Corn-and-cob meal, one-third	1.00
		Cottonseed hulls	9.89
		Mixed alfalfa hay	4.16
3	16	Cottonseed meal, one-third	1.23
		Corn-and-cob meal, two-thirds	2.44
		Cottonseed hulls	9.56
		Mixed alfalfa hay	4.05

Each calf in lot 1 ate an average of 2.61 pounds of cottonseed meal, 10.26 pounds of cottonseed hulls, and 4.31 pounds of hay during the whole fattening period of 107 days. It should be understood, however, that these calves were not started off suddenly with these amounts of feeds; they gradually were made accustomed to the feeds, especially cottonseed meal, by beginning with small amounts. For instance, on November 17, the day the test was begun, each calf in this lot was given only 1.5 pounds of cottonseed meal, and this amount was divided equally between two feeds; on this same day each calf ate 7 pounds of cottonseed hulls and 4 pounds of hay. On December 2, or 15 days after the test began, the daily feed of each calf in the test had been raised to 2 pounds of cottonseed meal, 9 pounds of cottonseed hulls, and 4 pounds of hay. By January 13 the daily feed for each calf had been raised to 3 pounds of cottonseed meal, 11 pounds of cottonseed hulls, and a fraction over 4 pounds of hay. The daily allowance of cottonseed meal was not increased after this date.

The calves in lots 2 and 3 were fed somewhat more liberally on the concentrated part of the rations and more sparingly on the roughage parts. This could be done because of the introduction of corn-and-cob meal. Changes in either the amount or the kind of feed should be made gradually, especially when dealing with young animals.

WEIGHTS AND GAINS.

When the first weights were secured, in November, the calves averaged from 6 to 8 months in age. On this date they averaged 376 pounds in weight. Though not large for their age, they were considerably larger than the average for this State. Their dams were large for Alabama cows, probably averaging 1,000 pounds in weight in normal breeding condition, and they should have produced larger calves. In Department Bulletin 73 it is seen that calves averaging 460 pounds at 9½ months of age were gotten from cows which averaged only 630 pounds in weight in their winter form, or about 850 pounds in the summer. The calves, however, had not been pampered in any way during the summer months; they simply had run with their dams on a reasonably good pasture.

Table 2 shows that exceedingly satisfactory gains were secured during this winter test:

TABLE 2.—*Weights, total gains, and average daily gains (November 17, 1911, to March 3, 1912).*

Lot No.	Number of calves.	Ration.	Average initial weight of calves.	Average final weight of calves.	Total gain of each calf.	Average daily gain of each calf.
			Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
1	16	Cottonseed meal Cottonseed hulls Mixed alfalfa hay	376	584	208	1.94
2	15	Cottonseed meal, two-thirds Corn-and-cob meal, one-third Cottonseed hulls Mixed alfalfa hay	375	562	187	1.75
3	16	Cottonseed meal, one-third Corn-and-cob meal, two-thirds Cottonseed hulls Mixed alfalfa hay	376	546	170	1.59

The gains were all satisfactory, but an exact reverse of the results secured the previous winter. In the previous year's test the calves that were fed corn-and-cob meal along with the cottonseed meal gained more rapidly than those that ate cottonseed meal as the sole concentrate, and the greater the amount of corn-and-cob meal eaten the more rapid the gains. The calves in lot 1, which ate cottonseed meal, gained at an average daily rate of 1.94 pounds, while the calves in lots 2 and 3, where the cottonseed meal was supplemented and partly replaced by corn-and-cob meal gained at the respective rates of 1.75 and 1.59 pounds daily. The only explanation that can be offered is that the calves of all lots were fed more concentrate per head daily during the winter of 1910–11 than they were during the winter of 1911–12, and the amount of concentrates fed for lots 2 and 3 in 1911–12 was too small to make large gains on fattening calves.

When sold, March 3, 1912, these calves were, on the average, about 12 months old. Those in lot 1 had attained an average weight of 584 pounds, but those in lots 2 and 3 were somewhat lighter. Although not large, these calves were perhaps as large at 12 months as the average southern steer at twice the age. The increased size was due partly to the infusion of some good beef blood and partly to liberal feeding and good care.

QUANTITY AND COST OF FEED REQUIRED TO MAKE 100 POUNDS OF GAIN.

The finishing or fattening period continued from November 17, 1911, to March 3, 1912, a period of 107 days. During this time the calves were fed practically all they would eat, especially of the roughages, hay and hulls. The grain part of the rations was limited in every case to a definite and rather small amount. But Table 2 shows that satisfactory gains were obtained, and Table 3 shows that the cost to make 100 pounds of gain was not excessive, although the feeds used were all expensive ones. In fact, the gains were made cheaply in every case, much more cheaply than can be made with older animals, the cost per hundred pounds ranging from $5.14 to $6.43. In the previous winter's work it cost from $6.19 to $6.83 to make 100 pounds of increase in weight where the same kind of calves were used and the same kind of feeds employed, yet in referring to the cheapness of gains of the calves the authors stated that—

> The gains were made cheaply. This was due to several factors. First, the calves were young and growing, and young animals of all kinds can be made to increase in weight more economically than old ones. Second, the calves were very thrifty, and so made good use of the feed that they ate. Third, all of the rations were extremely palatable, especially the two which had the corn-and-cob meal mixed with the cottonseed meal. A young animal of any kind will not make satisfactory gains on an unpalatable ration. Fourth, the calves had comfortable quarters and were fed and watered regularly.

TABLE 3.—*Quantity and cost of feed required to make 100 pounds of gain (Nov. 17, 1911, to Mar. 3, 1912, 107 days).*

Lot No.	Ration.	Total amount of feed eaten by each calf.	Pounds of feed to make 100 pounds of gain.	Cost of feed to make 100 pounds of gain.
		Pounds.	*Pounds.*	
1	Cottonseed meal	279	134	$5.14
	Cottonseed hulls	1,098	528	
	Mixed alfalfa hay	462	222	
2	Cottonseed meal, two-thirds	215	115	5.72
	Corn-and-cob meal, one-third	107	58	
	Cottonseed hulls	1,058	566	
	Mixed alfalfa hay	445	238	
3	Cottonseed meal, one-third	130	77	6.43
	Corn-and-cob meal, two-thirds	260	154	
	Cottonseed hulls	1,023	602	
	Mixed alfalfa hay	423	255	

The calves in lot 1, where cottonseed meal, hulls, and mixed hay were used, made the cheapest gains, each 100 pounds of gain in the lot, costing only $5.14, whereas an equal amount of increase in weight in lots 2 and 3, where corn-and-cob meal constituted a part of the ration, cost $5.72 and $6.43, respectively. In this test the corn-and-cob meal did not cheapen the ration in either case. In the test previously reported, the introduction of a small amount of corn-and-cob meal did decrease the cost a few cents, but where the larger proportion of corn-and-cob meal was employed it cost more to make 100 pounds of gain than in the lot where cottonseed meal was the sole concentrated feed. Lot 3 in both experiments showed up to a considerable disadvantage. When the two tests are considered together, sufficient evidence is at hand to show conclusively that it does not pay to replace two-thirds of the cottonseed meal part of the ration by corn-and-cob meal when cottonseed meal can be bought at $26 a ton and corn costs 70 cents a bushel.

In lot 1 only 134 pounds of cottonseed meal, 528 pounds of cottonseed hulls, and 222 pounds of hay were required to produce a gain in weight of 100 pounds; this was an extremely satisfactory outcome. In lot 2, where one-third of the grain part of the ration was made up of corn-and-cob meal, to make an equal number of pounds of increase required 115 pounds of cottonseed meal, 58 pounds of corn-and-cob meal, 566 pounds of hulls, and 238 pounds of hay. The introduction, therefore, of the corn-and-cob meal caused a corresponding increase in both the total pounds of grain and roughage required to make 100 pounds of gain. In lot 3, where two-thirds of the grain part of the ration was made up of corn-and-cob meal, to make 100 pounds of increase in weight required the use of 77 pounds of cottonseed meal, 154 pounds of corn-and-cob meal, 602 pounds of cottonseed hulls, and 255 pounds of hay. This was unsatisfactory indeed when compared with the results obtained in lot 1, where no corn-and-cob meal was used.

This test indicates that while cottonseed meal and hulls are cheap, and corn and farm-grown roughage, such as hay, are high-priced, it pays better to purchase such commercial feeds as cottonseed meal and hulls than to purchase corn and hay for fattening calves. However, the boll weevil and the campaign for diversified farming are causing a change in the farming methods of the South, with the result that corn will be raised to a greater extent, a surplus being produced in some sections, and more forage will be raised. The by-products from such farming usually will have to be fed on the farm, and will be much cheaper than the prices charged here. Then, too, such feeds will be produced by many farmers who can not market them because of remoteness from markets, poor roads, poor shipping facilities or high freight rates, and lack of knowledge about the proper preparation of such feeds for the market. Under such conditions the feeds can be used profitably for the stock.

With the prices of feeds charged in this experiment, if all profit is reckoned as the price received for the corn fed, the calves of lot 2 returned $3.57 per bushel for each bushel of corn consumed, and those of lot 3 returned $1.62 per bushel for the corn. Or, if all feeds except hay are charged at market prices and the profit is considered as the price received for the hay consumed, the hay was sold by means of the calves at prices ranging from $29.81 to $37.43 per ton.

In this experiment it paid, and paid well, to buy both cottonseed meal and hulls and sell them by means of the calves; but it was also very profitable to use the calves as a means of marketing the hay and the corn which were grown upon the farm.

SLAUGHTER DATA.

At the close of the test the calves which had been sold by farm weights were shipped to Meridian, Miss., where complete individual slaughter records were secured. Immediately after securing the final farm weights the calves were driven from the farm to Epes, Ala., a distance of 9 miles, to be shipped. They were on the cars approximately 14 hours, and were fed and watered once after reaching their destination and before the final weights were taken.

Table 4.—Slaughter data.

Lot No.	Ration.	Average final farm weight.	Average final farm weights after 3 per cent shrinkage.	Average market weight.	Average loss in shipping.	Percentage dressed out by farm weights.	Percentage dressed out by market weights.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Per cent.*	*Per cent.*
1	Cottonseed meal Cottonseed hulls Mixed alfalfa hay	562	545	500	62	46.3	50.56
2	Cottonseed meal, two-thirds Corn-and-cob meal, one-third Cottonseed hulls Mixed alfalfa hay	552	535	489	63	47.3	51.8
3	Cottonseed meal, one-third Corn-and-cob meal, two-thirds Cottonseed hulls Mixed alfalfa hay	539	523	487	52	46.3	49.7

The calves lost heavily in weight, as a result of being shipped. Those in lots 1 and 2 lost practically the same, 62 and 63 pounds, respectively, but those in lot 3, where more corn-and-cob meal was used, did not suffer such great losses, as each calf in this lot shrank only 52 pounds. The last two columns of Table 4 show that the calves were not very fat as compared with corn-fed cattle of the North. They were, however, in good killing condition and suited the local market demand. The animals in lots 1 and 2 dressed out, by market weights, practically the same, 50.56 per cent and 51.8 per cent, respectively. Those in the third lot were not so well finished, as shown by the fact that they dressed out only 49.7 per cent by their market weight.

Taken as a whole, the shrinkage on these calves amounted to 10.7 per cent of their final farm weight. The shipping distance was 40 miles, but it is not probable that they would have suffered a very much greater loss in weight had the distance been three or four times as great, for it is very probable that the greatest portion of the loss in weight occurred during the drive to the loading point.

FINANCIAL STATEMENT.

The majority of these calves were raised on the farm on which they were fattened. A few, however, were purchased from neighboring farmers; those purchased cost 4 cents a pound, and as they very accurately represented an average of the whole number, the initial or fall value of all was placed at 4 cents a pound on the farm without shrinkage. When they were ready to be marketed buyers visited the farm and made bids. They were sold to a buyer of Meridian, Miss., for 5½ cents a pound on the farm, after a 3 per cent deduction on farm weights. The buyer, therefore paid all expenses of shipping.

The following statements show the complete financial record:

TABLE 5.—*Financial statement.*

Lot 1. Cottonseed meal, cottonseed hulls, mixed alfalfa hay:	
To 16 calves—6,010 pounds, at 4 cents a pound	$240.40
To 4,466 pounds of cottonseed meal, at $26 a ton	58.06
To 17,568 pounds of cottonseed hulls, at $7 a ton	61.49
To 7,380 pounds of mixed alfalfa hay, at $14 a ton	51.66
Total expenditures	411.61
By sale of 16 calves—9,336 pounds, at 5½ cents a pound	498.07
Total profit on lot	86.46
Average profit on each calf	5.40
Lot 2. Cottonseed meal two-thirds, corn-and-cob meal one-third, cottonseed hulls, mixed alfalfa hay:	
To 15 calves—5,623 pounds, at 4 cents a pound	224.92
To 3,220 pounds of cottonseed meal, at $26 a ton	41.86
To 1,610 pounds of corn-and-cob meal, at $20 a ton	16.10
To 15,872 pounds of cottonseed hulls, at $7 a ton	55.55
To 6,677 pounds of mixed alfalfa hay, at $14 a ton	46.74
Total expenditures	385.17
By sale of 15 calves—8,430 pounds, at 5½ cents a pound	449.74
Total profit on lot	64.57
Average profit on each calf	4.30
Lot. 3. Cottonseed meal one-third, corn-and-cob meal two-thirds, cottonseed hulls, mixed alfalfa hay:	
To 16 calves—6,010 pounds, at 4 cents a pound	240.40
To 2,083 pounds of cottonseed meal, at $26 a ton	27.08
To 4,166 pounds of corn-and-cob meal, at $20 a ton	41.66
To 16,370 pounds of cottonseed hulls, at $7 a ton	57.30
To 6,932 pounds of mixed alfalfa hay, at $14 a ton	48.52
Total expenditures	414.96
By sale of 16 calves—8,730 pounds, at 5½ cents a pound	480.15
Total profit on lot	65.19
Average profit on each calf	4.07

As previously stated, hogs followed the calves that had a partial ration of corn-and-cob meal and received some benefit from the droppings. This item does not appear in the above financial statement, but it is discussed in a later paragraph.

Leaving out of consideration for the present the results secured from the hogs, it is seen that the greatest profit was realized on the calves that were fed cottonseed meal, cottonseed hulls, and mixed alfalfa hay. It did not pay to feed the corn-and-cob meal along with the cottonseed meal at the prevailing prices of the two feeds, and the greater the proportion of corn used the smaller the resultant profits. In lot 1 each calf returned a clear profit of $5.40; but in lot 2, where one-third of the cottonseed meal was replaced by corn-and-cob meal, a profit of only $4.30 was made on each animal; and in lot 3, where two-thirds of the cottonseed meal was replaced by corn-and-cob meal, the profit per calf dropped to $4.07. All the profits, however, were satisfactory; but, leaving out of consideration the profits derived from the hogs, the cottonseed meal ration proved to be the most profitable.

HOGS FOLLOWING CALVES.

It was thought that if hogs were allowed to follow the calves that ate a partial ration of corn-and-cob meal they would derive some benefit from the undigested corn in the droppings. In a former test[1] an effort was made to get some benefit from the droppings when the steers ate nothing except cottonseed meal as the concentrate, but this ended in a failure, so no pigs were placed in lot 1. Eight pigs, averaging 87 pounds in weight, were placed in lot 2, and an equal number, averaging 89 pounds in weight, in lot 3. Of course, these pigs were not able to secure sufficient feed from the droppings alone to produce rapid gains, so the droppings were supplemented by corn. These pigs followed the calves throughout the test, and during the whole time those in lot 2 ate 3,715 pounds of shelled corn in addition to what undigested corn they secured from the droppings of the calves, but those in lot 3 ate only 2,953 pounds of corn. These feeds caused all the pigs to make rapid gains. Those in the second lot increased in weight 805 pounds, but the pigs in the third lot increased in weight only 689 pounds.

Small profits were made on each one of the lots of pigs, and these profits should be credited to the calves, or at least added to the total profits made in lots 2 and 3. With corn valued at 70 cents a bushel and hogs selling at 7 cents a pound, the hogs in lot 2 and 3 returned final profits of $9.91 and $11.32, respectively. When these profits are added to those already secured upon the calves in these two lots, the total profits on each calf were increased to $4.97 in lot 2 and to $4.78 in lot 3.

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[1] Bureau of Animal Industry Bulletin 103.

When the combined profits on the hogs and the calves in lots 2 and 3 are considered, it is seen that they are still smaller than the profits realized on the calves of lot 1, where cottonseed meal was the sole concentrate.

SUMMARY STATEMENTS.

1. The objects of this test were (1), to learn whether a farmer profitably can raise and fatten calves for the market by the time they are a year old, and, (2), to make a comparison of southern feeds and combinations of feeds which may be used for fattening calves during the winter months.

2. The calves were all high-grade animals, being far better than the average of the State. When the feeding test began, November 17, 1911, they averaged 376 pounds in weight and were from 6 to 8 months of age.

3. The 47 calves were divided into three lots and fed from November 17, 1911, to March 3, 1912, on the following feeds:

Lot 1. Cottonseed meal; cottonseed hulls; mixed alfalfa hay.

Lot 2. Cottonseed meal, two-thirds; corn-and-cob meal, one-third; cottonseed hulls; mixed alfalfa hay.

Lot 3. Cottonseed meal, one-third; corn-and-cob meal, two-thirds; cottonseed hulls; mixed alfalfa hay.

4. For the whole period of 107 days an average daily gain of 1.94, 1.75, and 1.59 pounds was secured in lots 1, 2, and 3, respectively.

5. For the whole period of 107 days it cost $5.14, $5.72, and $6.43 to make 100 pounds of increase in live weight in lots 1, 2, and 3, respectively.

6. In the fall of 1911 the calves cost 4 cents a pound. At the end of the test they were sold on the farm for 5½ cents a pound.

7. Each calf in lots 1, 2, and 3 netted a clear profit of $5.40, $4.30, and $4.07, respectively. Hogs followed the calves that received some corn and derived some benefit from the droppings. When the profits on the hogs, as well as on the calves, are taken into consideration, each calf in lots 1, 2, and 3 netted a clear profit of $5.40, $4.97, and $4.78, respectively.

8. In this particular test it did not pay, therefore, to add corn-and-cob meal to a basal ration of cottonseed meal, cottonseed hulls, and alfalfa hay if both farm-grown and purchased feeds are charged at market prices. On farms remote from markets, where a surplus of roughage and corn is produced, it would have been very profitable to feed the corn, as the farmer would have secured market prices for his roughage and corn and in addition would have made a nice profit on his calves, without the expenditure of much money for purchased feeds.

II. FATTENING BEEF CALVES ON COTTONSEED MEAL, COTTONSEED HULLS, CORN CHOP, AND CORN SILAGE.

PLAN OF WORK.

This test was conducted during the winter of 1912–13. The feeding began November 29, 1912, and closed, as far as the corn silage was concerned, March 3, 1913. The supply of corn silage was exhausted on March 3, but the calves were not ready for sale, so all were placed in one lot (they had formerly been divided into three lots for the sake of certain feed comparisons) and continued on a ration of cottonseed meal, corn chop, cottonseed hulls, and mixed alfalfa hay until April 29, 1913, when they were sold.

As these calves were of the same breeding, had been raised in the same way and from the same cows, and were fed in the same lots as those fully reported upon in Part I of this bulletin, it is not necessary to enter into a discussion of the objects of the work, of the kind of calves used, of the general plan of the work, of the method of feeding and handling, and of the shelter and lots.

THE RATIONS EMPLOYED.

Practically the only material way in which this test varied from the previous one was in the feeds used. In this test corn silage was introduced into the rations of two of the lots and was fed from November 29, 1912, to March 3, 1913, when the supply was exhausted. Each lot of 16 calves was fed the following feeds:

Lot 1. Cottonseed meal; cottonseed hulls.

Lot 2. Cottonseed meal, two-thirds; corn chop, one-third; cottonseed hulls; corn silage.

Lot 3. Cottonseed meal; cottonseed hulls; corn silage.

On March 3, 1913, they were all thrown together as one lot and continued to April 29, 1913, on the following:

Lot 4. Cottonseed meal; corn chop; cottonseed hulls; mixed hay.

Corn silage was the only new feed introduced. In the financial statements it is valued at $3 a ton, and the other feeds are valued as on page 7.

The cottonseed meal this year was fresh and bright, analyzing from 7.5 to 7.7 per cent ammonia. The cottonseed hulls were only fair in quality. The corn chop (made by grinding shelled corn) was of excellent quality. The corn from which the chop was made was grown upon the farm and was fresh and hard. The corn silage, however, was poor in quality owing to the fact that the fodder had become too dry before it was made into silage.

DAILY RATIONS.

The test proper did not begin until November 29, 1912. Previous to this time, however, the calves were eating a small daily ration composed of cottonseed meal, cottonseed hulls, and mixed hay. The preliminary period continued 15 days, during which time the calves became accustomed to eating dry feeds.

Table 16 shows the average amount of feed eaten daily by each calf, but it should be borne in mind that these amounts were reached by gradual and careful increases.

TABLE 6.—*Average daily rations (Nov. 29, 1912, to Mar. 3, 1913).*

Lot No.	Number of calves.	Ration.	Average amount of feed eaten by each calf daily.
			Pounds.
1	16	Cottonseed meal	2.61
		Cottonseed hulls	14.13
2	15	Cottonseed meal, two-thirds	1.76
		Corn chop, one-third	.88
		Cottonseed hulls	6.56
		Corn silage	13.29
3	15	Cottonseed meal	2.63
		Cottonseed hulls	6.53
		Corn silage	13.03

When the test began, each calf in lot 1 was eating daily a little less than 2 pounds of meal and 11 pounds of hulls. It should be remembered that the calves had been eating these feeds for 15 days before the test began. On December 12, or 14 days later, the 16 calves were raised to a daily ration of 34 pounds of cottonseed meal and 220 pounds of cottonseed hulls. On January 3 another increase in the meal was made, when the daily allowance was increased to 40 pounds. On January 14 a third increase was made, when the cottonseed meal was increased to 44 pounds. The 16 calves never ate more than 56 pounds of cottonseed meal daily, or 3½ pounds per head per day.

If the corn silage had been of better quality, each calf would have eaten much more than 13 pounds daily. Each calf should have consumed not less than 20 pounds. No hay was used in this test; cottonseed hulls were used in place of the hay. In addition to the amount of silage eaten daily, it is seen that each calf in lots 2 and 3 ate 5.56 and 6.53 pounds, respectively, of cottonseed hulls.

WEIGHTS AND GAINS.

When the test was begun, November 29, 1912, the calves averaged from 6 to 8 months in age. As stated previously, they were out of the same cows as the calves that were used in the experiment reported in Part I, and were consequently similar in size, breeding, and quality. When the test began, the 46 calves averaged 371 pounds in weight. During the summer months the calves had run with their dams upon a reasonably good pasture. These calves, during the pasture season, became infested with cattle ticks, as the cattle grazed in a very large wooded pasture of 20,000 acres and it was a difficult matter to find all of them at each dipping period. The ticks doubtless interferred with the development of the calves. The calves that were used in the previous year's work were raised in a pasture that was almost, if not quite, free of ticks, and they were considerably heavier than the calves used in the present test.

TABLE 7.—*Weights, total gains, and average daily gains (Nov. 29, 1912, to Mar. 3, 1913).*

Lot No.	Number of calves.	Ration.	Average initial weight of calves.	Average final weight of calves.	Average total gain per calf.	Average daily gain per calf.
			Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
1	16	Cottonseed meal Cottonseed hulls	365	505	140	1.49
2	15	Cottonseed meal, two-thirds Corn chop, one-third Cottonseed hulls Corn silage	393	508	115	1.23
3	15	Cottonseed meal Cottonseed hulls Corn silage	357	497	140	1.49

It is interesting to note the effect upon the daily gains of calves when one-third of the ration of cottonseed meal is replaced by corn chop. Each calf in lot 3 ate, on the average, 2.63 pounds of cottonseed meal each day. Each calf in lot 2 consumed 1.76 pounds of cottonseed meal plus 0.88 pound of corn chop each day; that is, each pound of corn chop replaced one pound of cottonseed meal. When this was done the last column in Table 7 shows that the daily gains were reduced materially. That is, one pound of corn was not equal to one pound of cottonseed meal as a fattening ration for calves. In lot 3, where cottonseed meal, cottonseed hulls, and corn silage were fed, the calves gained at the rate of 1.49 pounds daily. In lot 2, where a part of the cottonseed meal was replaced by corn chop (one pound of corn chop replacing one pound of cottonseed meal), the average daily gains dropped to only 1.23 pounds. The calves in lot 1, where only cottonseed meal and cottonseed hulls were fed, gained at the rate of 1.49 pounds daily, or exactly the same as the daily gains recorded in lot 3.

QUANTITY AND COST OF FEED REQUIRED TO MAKE 100 POUNDS OF GAIN.

In the following statement cottonseed meal is valued at $26 a ton, cottonseed hulls at $7 a ton, corn silage at $3 a ton, and corn at 70 cents a bushel. These prices represent fairly accurately the average prices of the State. In this test, as well as in the previous one, the cost of making 100 pounds of gain was not excessive.

TABLE 8.—*Quantity and cost of feed required to make 100 pounds of gain.*

Lot No.	Ration.	Total feed eaten by each calf.	Average feed to make 100 pounds of gain.	Average cost of feed to make 100 pounds of gain.
		Pounds.	*Pounds.*	
1	Cottonseed meal	245	175	$5.59
	Cottonseed hulls	1,329	946	
2	Cottonseed meal, two-thirds	164	144	6.09
	Cottonseed hulls	617	536	
	Corn chop, one-third	82	72	
	Corn silage	1,249	1,084	
3	Cottonseed meal	267	176	5.13
	Cottonseed hulls	614	438	
	Corn silage	1,225	875	

The cheapest gains were made in lot 3, where a ration of cottonseed meal, cottonseed hulls, and corn silage was used, as each 100 pounds of increase in live weight cost $5.13. It should not be inferred immediately, however, from the above that this combination of feeds is the best of the three. The cost of the gains does not determine absolutely the final profits. Although the cost of the gains is a very important factor in determining final profits, there are other factors which must be taken into consideration as well. The final selling price of the cattle must be considered as an important factor. If expensive gains are accompanied by a proportionate increase in the final value and selling price of the cattle, the cost of the gains is a minor consideration; but if expensive gains do not increase the final selling price of the animal in proportion to the increased expense of making the gains those feeds which have caused the expensive gains should be eliminated. The most expensive gains were encountered in lot 2, where corn chop replaced a part of the cottonseed meal. In this lot it cost $6.09 to make 100 pounds of increase in weight. Where only cottonseed meal and cottonseed hulls were fed (lot 1) each 100 pounds of gain was made at a cost of $5.59.

When the results of lots 1 and 3 are compared it is seen that 875 pounds of corn silage saved 508 pounds of cottonseed hulls. At this rate 1 ton of corn silage saved 1,161 pounds of cottonseed hulls; when hulls are valued at $7 a ton the corn silage, therefore, was worth for fattening these calves $4.06 a ton.

FINANCIAL STATEMENT FOR THE SILAGE PERIOD.

The supply of silage was exhausted March 3, 1913. The calves had been in the feed lot only 94 days and they were not in condition to be sold at that date. Therefore they were all thrown together in one lot and fed from March 3 to April 29—a period of 58 days—on a ration of cottonseed meal, corn chop, cottonseed hulls, and mixed hay.

Before the silage period ended an estimated value was placed on each lot of calves. The calves in lot 1 were in much better condition than those in either of the other two lots, so they were valued at 5½ cents a pound and the calves in lots 2 and 3 at 5¼ cents a pound. At the beginning of the experiment, November 29, 1912, they were all valued at 4½ cents a pound.

TABLE 9.—*Financial statement for silage period.*

Lot 1. Cottonseed meal, cottonseed hulls:	
To 16 calves—5,836 pounds, at 4½ cents a pound	$262.62
To 3,925 pounds of cottonseed meal, at $26 a ton	51.03
To 21,258 pounds of cottonseed hulls, at $7 a ton	74.40
Total expenditures	388.05
By sale of 16 calves—8,083 pounds, at 5½ cents a pound	431.23
Total profit on lot	43.18
Average profit on each calf	2.70
Lot 2. Cottonseed meal, two-thirds; corn chop, one-third; cottonseed hulls; corn silage:	
To 15 calves—5,900 pounds, at 4½ cents a pound	$265.50
To 2,481 pounds of cottonseed meal, at $26 a ton	32.25
To 1,236 pounds of corn chop, at $20 a ton	12.36
To 9,253 pounds of cottonseed hulls, at $7 a ton	32.39
To 18,734 pounds of corn silage, at $3 a ton	28.10
Total expenditures	370.60
By sale of 15 calves—7,628 pounds, at 5¼ cents a pound	388.46
Total profit on lot	17.86
Average profit on each calf	1.19
Lot 3. Cottonseed meal, cottonseed hulls, corn silage:	
To 15 calves—5,350 pounds, at 4½ cents a pound	240.75
To 3,702 pounds of cottonseed meal, at $26 a ton	48.13
To 9,205 pounds of cottonseed hulls, at $7 a ton	32.22
To 18,375 pounds of corn silage, at $3 a ton	27.56
Total expenditures	348.66
By sale of 15 calves—7,420 pounds, at 5¼ cents a pound	377.86
Total profit on lot	29.20
Average profit on each calf	1.95

If these calves had been sold March 3, or when the supply of silage gave out, the greatest profit would have been made on the calves in lot 1, and the smallest profit in lot 2, where both corn chop and corn silage were used. But they were not ready to be sold upon that date. As a matter of fact 6 of the best heifers were taken out of the test on March 3 and kept on the farm for future breeding purposes, so only 40 calves were in the test from March 3 to April 29.

SUBSEQUENT FINISHING PERIOD.

During the short period of 58 days, from March 3 to April 29, 1913, each one of the calves ate 204 pounds of cottonseed meal, 52 pounds of corn chop, 346 pounds of cottonseed hulls, and 371 pounds of mixed hay. (The hay, in fact, more properly should be called Johnson-grass hay, as there was very little alfalfa in it; it was valued at $10 a ton.) During this period the calves did not make good gains—only 1.09 pounds daily. The cost to make the increase in live weight was more than normal, being $11.31 to make 100 pounds of gain.

Notwithstanding the fact that the gains were rather small during this last period of 58 days, the calves were in reasonably good condition at the end and sold for satisfactory prices. They were sold to a buyer of Meridian, Miss., by farm weight less 3 per cent shrinkage. The 30 largest and best calves sold for 7 cents a pound. The 5 smallest ones sold for 6 cents a pound, and 5 others sold for 6½ cents a pound. Table 10 shows the results of feeding the 40 calves during the last 58 days. The initial cost—$5.40 per hundredweight—represents the value placed upon them at the close of the silage period, March 3.

Table 10.—*Financial statement for last period of 58 days.*

Lots 1, 2, and 3 combined. Cottonseed meal, corn chop, cottonseed hulls, mixed hay:	
To 40 calves—21,035 pounds, at $5.40 per cwt	$1,135.89
To 8,156 pounds of cottonseed meal, at $26 a ton	106.03
To 2,075 pounds of corn chop, at $20 a ton	25.94
To 13,848 pounds of cottonseed hulls, at $7 a ton	48.47
To 14,847 pounds of hay, at $10 a ton	74.24
Total expenditures	1,390.57
By sale of 40 calves	1,562.92
Total profit on 40 calves for last 58 days	172.35
Average profit on each calf for feeding period of last 58 days	4.31
Average profit on each calf for first 94 days	1.96
Total profit on each calf	6.27

These calves sold for good prices and finally returned excellent profits, as a clear profit of $6.27 was realized on each animal. If they had been sold March 3, an average net profit of only $1.96 would have been made on each calf, so it paid well to hold them longer and finish them more. The most of the profit was made during the last 58 days.

SUMMARY STATEMENT.

1. The objects of this test and the kinds of calves used were very similar to those of the previous test.

2. The whole number of 46 calves was divided into three lots and fed from November 29, 1912, to March 3, 1913, the following rations:

Lot 1. Cottonseed meal; cottonseed hulls.

Lot 2. Cottonseed meal, two-thirds; corn chop, one-third; cottonseed hulls; corn silage.

Lot 3. Cottonseed meal; cottonseed hulls; corn silage.

The supply of corn silage was exhausted by March 3, but the calves were not ready for the market, so on this date they were all thrown together as one lot and continued on:

Cottonseed meal; corn chop; cottonseed hulls; mixed hay.

3. During the silage period (November 29 to March 3) an average daily gain of 1.49, 1.23, and 1.49 pounds was secured in lots 1, 2, and 3, respectively.

4. During the silage period (November 29 to March 3) it cost $5.59, $6.09, and $5.13 to make 100 pounds of increase in live weight in lots 1, 2, and 3, respectively.

5. In the fall of 1912 the calves cost 4½ cents a pound. At the end of the silage period they were not ready to be sold and estimated values were placed upon each lot. The calves in lot 1 were valued at 5½ cents a pound, and those in lots 2 and 3 at 5¼ cents a pound.

6. Each calf during the silage period netted a clear profit of $2.70, $1.19, and $1.95 in lots 1, 2, and 3, respectively.

7. By comparing lot 1 with lot 3 it is found that one ton of corn silage saved 1,161 pounds of cottonseed hulls. If cottonseed hulls cost $7 per ton, the corn silage, therefore, was worth $4.06 per ton for fattening these calves.

8. This test clearly demonstrates that if corn is to replace part of a cottonseed meal ration, more than one pound of corn should be used to take the place of one pound of cottonseed meal. In other words, cottonseed meal has a greater feeding value, pound for pound, than shelled corn.

9. After the supply of silage was exhausted the calves were all fed 58 days longer on a ration composed of cottonseed meal, corn chop, cottonseed hulls, and mixed hay. They gained during this period only 1.09 pounds daily, but their value increased very materially, and at the end they sold for almost 7 cents a pound on the farm.

10. For the entire period November 29 to April 29 each calf returned a clear profit of $6.27.

III. FATTENING CALVES ON COTTONSEED MEAL, CORN, COTTONSEED HULLS, CORN SILAGE, AND ALFALFA HAY.

TRANSFER OF WORK FROM ALABAMA TO MISSISSIPPI.

The cattle-feeding work which was conducted in Alabama in cooperation with the Experiment Station from 1904 to 1913 was transferred to the tick-free sections of Mississippi in 1914. An experimental farm was established near Canton, Miss., in the "brown loam" section of the State, and another at Abbott, Miss., near West Point, in the black-prairie section. The work which is reported herewith was conducted on the farm of Mr. Ben Walker at Abbott.

That section of Mississippi has long been recognized as a splendid live-stock section, for the prairie soils have a large lime content which induces good growth in the various clovers and alfalfa, thus furnishing good pastures and an abundance of forage. Conditions are very similar to those in western Alabama, where the former work was conducted. The land in the Mississippi pastures was not so rolling as in Alabama, but there was little difference in the type of soil and its fertility.

The object of this test was to get further information concerning the use of cottonseed meal and mixtures of cottonseed meal and corn for finishing calves for the market. This is a continuation of the work conducted in Alabama.

CALVES USED.

The calves used in the experiment were grade Shorthorn, Angus, and Red Polled, the Shorthorns predominating in numbers. They were out of grade beef cows and sired by registered bulls. All but one were raised upon the farm and ran with their dams in black-prairie pastures until just before the test was started. In size they were somewhat larger than the average Mississippi calves at weaning time, but they were of about the same size and quality as the grade beef calves found upon the good stock farms of the State. They represented the second or third cross of good beef bulls on the native Mississippi cows. They averaged 400 pounds each when taken from their dams on October 25, 1914, to be weaned, dehorned, and started on a preliminary feed. All calves were valued at 5 cents a pound on the farm without any deduction for shrinkage.

FEED LOTS AND WATER SUPPLY.

All the calves were fed in a large barn, which was open enough on the sides to permit thorough ventilation. About 50 square feet of space was allowed for each calf for lying down and exercising.

The plan of the barn was such that the calves could not have the run of the open lots. The pens were kept well bedded for the first six weeks, but there were so many steers on feed at the same time that but small amounts of bedding could be used after the sixth week. The pens were muddy and sloppy during the latter half of the feeding periods.

A water trough was in each pen and water was furnished from a deep well. Feed throughs were used for feeding the silage and grain, and the alfalfa was fed in racks over the troughs. The shattered leaves from the racks fell into the feed trough, so there was no waste of feed.

The feeding was done at 7 o'clock in the morning and 3 o'clock in the afternoon.

CHARACTER AND PRICE OF THE FEEDS.

As this experiment was for the comparison of grain rations the roughage for all lots was the same. The calves of all lots were fed about 5½ pounds of cottonseed hulls and 3½ pounds of alfalfa hay per head daily and given in addition all of the silage they would eat.

The cottonseed meal was about the average in quality. Analysis showed an ammonia content equal to about 7.2 per cent nitrogen. The corn was not quite as good as the average of Mississippi corn.

The cottonseed hulls were of average quality, the hulls used being good for the entire time except for a very short period when some hulls of an inferior grade were received. These were fed but a few days until good hulls could be obtained. The alfalfa hay was bright and of good quality, but contained a little Johnson grass. The corn silage contained very little grain this year and was not as good as usually is made on southern farms. Taken as a whole the feeds, with the exception of the silage, were just about the average of what are used on the stock farms of the South during average years.

The following prices were used for the feeds:

Cottonseed meal	per ton	$23.50
Cottonseed hulls	do	6.50
Corn-and-cob meal	per bushel	.70
Corn silage	per ton	3.00
Alfalfa hay	do	15.00

The prices used for cottonseed hulls and meal were the actual cost, whereas the prices used for other feeds were those used in other experiments and represented a good price for the farm-grown feeds and a profit to the farm in the production of them.

AVERAGE DAILY RATIONS BY PERIODS.

The calves of all lots had a preliminary feeding period from October 25 to November 13, during which time they were getting accustomed to the feed lots, to eating their feeds, and were recovering from dehorning. They were therefore in condition to take readily to their feeds when started in the regular feeding period beginning November 13. The feeds for all calves were increased gradually until the end of the second 28-day period, after which time the amount of concentrates was maintained at the same figures.

The calves of each lot were given daily about the same amount of cottonseed hulls with which the concentrates were mixed and had in addition all the alfalfa hay and corn silage they would eat. The weighed hay was put in racks for the calves to eat at will and such an amount of silage was fed as the calves would clean up in one hour after feeding. It is seen that the calves receiving corn-and-cob meal did not eat quite as much alfalfa or corn silage as the calves of lot 1.

TABLE 11.—*Average daily rations by 28-day periods (Nov. 14, 1914, to Apr. 5, 1915).*

Lot No.	Number of calves.	Ration.	First period.	Second period.	Third period.	Fourth period.	Fifth period, 31 days.
			Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1	14	Cottonseed meal	2.8	3.4	4.0	4.0	4.0
		Cottonseed hulls	5.0	5.0	6.1	6.4	6.8
		Corn silage	11.3	11.4	13.8	14.2	14.8
		Alfalfa hay	3.6	3.9	3.4	2.7	3.9
2	12	Cottonseed meal	2.6	3.3	3.3	3.3	3.6
		Corn-and-cob meal	1.3	1.6	1.6	1.6	1.8
		Cottonseed hulls	4.9	4.7	5.7	6.4	7.1
		Corn silage	11.1	11.2	12.9	14.2	15.1
		Alfalfa hay	3.3	3.6	3.1	3.3	4.4
3	14	Cottonseed meal	1.4	1.8	1.9	1.9	2.0
		Corn-and-cob meal	2.9	3.6	3.7	3.7	3.9
		Cottonseed hulls	5.0	4.7	4.8	5.3	6.3
		Corn silage	11.2	11.1	11.5	11.8	13.9
		Alfalfa hay	3.5	3.6	3.2	2.7	4.1

During the first 28-day period the calves of lot 1 consumed on the average 2.8 pounds of cottonseed meal, 5 pounds of cottonseed hulls, 3.6 pounds alfalfa hay, and 11.3 pounds of silage, while the calves of lot 2 consumed 2.6 pounds of cottonseed meal and one-half as much corn-and-cob meal. Each calf in lot 3 ate 4.3 pounds of the mixture of one-third cottonseed meal and two-thirds corn-and-cob meal per head per day.

During the third period and thereafter each calf of lots 1, 2, and 3 was fed 4, 4.9, and 5.6 pounds of concentrates per day, respectively. As these calves were less than 12 months old, it seemed best not to feed them more cottonseed meal than these amounts. As the calves were never fed a heavy grain ration, the amount of roughage consumed did not decrease as the feeding progressed, but in fact increased gradually as the calves increased in weight. The amount of alfalfa hay consumed by each lot was very uniform for all lots and for all periods of the experiment. For some unknown reason the calves of all lots consumed more silage than usual during the last two periods and somewhat less hay than the average.

WEIGHTS AND GAINS.

The calves used in this experiment were raised on tick-free pastures and weighed over 400 pounds each, being somewhat heavier at weaning time than the calves used in previous tests. They were of about the same quality and breeding as the calves used in former years. They were put on a preliminary feed from October 25 to November 13, and during that time they were dehorned and the males castrated.

The calves were weighed individually on three consecutive days and an average was made of all weighings and used as the initial weight. The regular feeding period began November 13, 1914. Each lot of calves was weighed every 28 days during the test, and all calves were weighed individually at the close of the test. The calves were weighed about 10 o'clock each weigh day.

Table 12.—*Weights and gains (Nov. 13, 1914, to Apr. 5, 1915, 143 days).*

Lot No.	Ration.	Average initial weight per calf.	Average final weight per calf.	Average total gains per calf.	Average daily gains per calf.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
1	Cottonseed meal Cottonseed hulls Corn silage Alfalfa hay	437	682	245	1.71
2	Cottonseed meal, two-thirds Corn-and-cob meal, one-third Cottonseed hulls Corn silage Alfalfa hay	427	695	268	1.87
3	Cottonseed meal, one-third Corn-and-cob meal, two-thirds Cottonseed hulls Alfalfa hay	436	663	227	1.59

[1] Preliminary feeding Oct. 25 to Nov. 12, inclusive.

The calves of lots 1, 2, and 3 were about the same size at the beginning of the test, averaging 437, 427, and 436 pounds, respectively. During the entire feeding period of 143 days the calves in each lot made a total gain of 245, 268, and 227 pounds per head, or an average daily gain of 1.71, 1.87, and 1.59 pounds per head. The gains for the first two lots were very satisfactory for calves of this size and quality. The gain for lot 3 was not so satisfactory, but when the daily rations of the calves are considered it is seen that the calves of lot 3 did not get as valuable a grain ration as those of lot 2, if the theory is true that one pound of cottonseed meal is equal in feeding value to two pounds of corn for fattening calves.

QUANTITY AND COST OF FEED REQUIRED TO MAKE 100 POUNDS OF GAIN.

Figures showing the amount of different kinds or combinations of feeds required to make 100 pounds of gain in weight are of most importance to prospective feeders. When a feeder knows the valuation of his cattle and the available feeds, he can determine easily which feeds it will be most profitable to use, if he is given the data showing the amount of feed required to make 100 pounds of gain and the effects of such feeds on the quality of the carcass and knows the selling price of the animal.

TABLE 13.—*Quantity and cost of feed required to make 100 pounds of gain (Nov. 13, 1914, to Apr. 5, 1915, 143 days).*

Lot No.	Ration.	Feed to make 100 pounds of gain.	Cost of 100 pounds gain.
		Pounds.	
1	Cottonseed meal	214	$6.34
	Cottonseed hulls	346	
	Corn silage	774	
	Alfalfa hay	207	
2	Cottonseed meal, two-thirds	172	6.34
	Corn-and-cob meal, one-third	86	
	Cottonseed hulls	309	
	Corn silage	690	
	Alfalfa hay	191	
3	Cottonseed meal, one-third	112	7.40
	Corn-and-cob meal, two-thirds	225	
	Cottonseed hulls	331	
	Corn silage	753	
	Alfalfa hay	217	

There is not a great variation in the amount of roughage required to make 100 pounds of gain on the calves of the various lots. Each lot received the same roughage. The calves of lots 1, 2, and 3 required 1,327, 1,190, and 1,303 pounds of roughage, respectively, to make 100 pounds of gain in live weight. The calves of lot 1, which consumed a small amount of concentrate per day, ate more roughage than either of the other lots and likewise they made a greater gain in weight than the calves of lot 3. The calves of lots 1 and 3 required about 100 pounds more roughage to make 100 pounds of gain than the calves of lot 2.

Since all the calves received the same kind of roughage and required about the same amount of roughage to make 100 pounds of gain, a direct comparison can be made of the concentrates.

When cottonseed meal was the sole concentrate the calves (lot 1) required 214 pounds to make 100 pounds of gain. The calves of lot 2 required 172 pounds of cottonseed meal and 86 pounds of corn-and-cob meal to make the same amount of gain, whereas the calves of lot 3 required 112 pounds of cottonseed meal and 225 pounds of corn-and-cob meal.

In this test, when one-third of the cottonseed meal was replaced by an equal amount of corn-and-cob meal each pound of cottonseed meal proved to be equal to 2.05 pounds of corn-and-cob meal, and when two-thirds of the ration was made up of corn-and-cob meal each 1 pound of cottonseed meal proved the equivalent of 2.21 pounds of corn-and-cob meal. This result has been in keeping with much of the other work done with corn and cottonseed meal in the South.

At the prices which prevailed for feeds in 1914–15, namely, cottonseed meal $23.50 per ton, corn 70 cents per bushel, cottonseed hulls $6.50 per ton, alfalfa hay $15 per ton, and silage at $3 per ton, the cost of 100 pounds of gain for lots 1, 2, and 3 was $6.34, $6.34, and $7.40, respectively. This is exceedingly satisfactory, as the average for all calves was less than 7 cents per pound of gain. For mature annimals fed on similar feeds the cost of each pound of gain would have been from 1½ to 4 cents more, showing the superior manner in which the calves utilize their feed. In fact, good calves are the only class of cattle that will put on gains in the feed lot at a price equal to or less than the selling price of the calves per pound.

FINANCIAL STATEMENT.

The calves used in this experiment were bought and inventoried at 5 cents a pound by farm weights without any shrinkage being deducted for fill. This price on the farm would have been equal to about 6 cents on the market, as it would have cost the producer about 1 cent a pound to cover the expense of shipping and marketing and the loss in weight. All feeds were charged at the prevailing prices named and charges were made for shipping and selling the calves. The total cost of freight, commission, feed, yardage, weighing, and insurance amounted to $2.17 per head.

TABLE 14.—*Financial statement (Nov. 13, 1914, to Apr. 5, 1915, 143 days).*

Lot 1. Cottonseed meal, cottonseed hulls, corn silage, alfalfa hay:	
To 14 calves—6,118 pounds, at $5 per hundredweight	$305.90
To 7,342 pounds cottonseed meal, at $23.50 per ton	86.27
To 11,853 pounds cottonseed hulls, at $6.50 per ton	38.52
To 26,533 pounds corn silage, at $3 per ton	39.80
To 7,110 pounds alfalfa hay, at $15 per ton	53.32
To freight, yardage, commission, insurance, etc., 14 head, at $2.175 per head	30.45
Total expenditures	554.26
By sale of 14 calves—8,740 pounds, at $7.25 per hundredweight	633.65
Total profit on lot 1	79.39
Average profit per calf	5.67
Lot 2. Cottonseed meal two-thirds, cottonseed hulls, corn-and-cob meal one-third, corn silage, alfalfa hay:	
To 12 calves—5,124 pounds, at $5 per hundredweight	256.20
To 5,529 pounds cottonseed meal, at $23.50 per ton	64.96
To 2,764 pounds corn-and-cob meal, at 70 cents per bushel	27.64
To 9,940 pounds cottonseed hulls, at $6.50 per ton	32.30
To 22,185 pounds corn silage, at $3 per ton	33.28
To 6,155 pounds alfalfa hay, at $15 per ton	46.16

To freight, yardage, commission, insurance, etc., 12 calves, at $2.175 per head	$26.10
Total expenditures	486.64
By sale of 10 calves—6,130 pounds, at $7.25 per hundredweight	444.42
By sale of 2 calves—1,200 pounds, at $6.50 per hundredweight	78.00
Total by sale of 12 calves	522.42
Total profit on lot 2	35.78
Average profit per calf	2.98
Lot 3. Cottonseed meal one-third, corn-and-cob meal two-thirds, cottonseed hulls, corn silage, alfalfa hay:	
To 14 calves—6,111 pounds, at $5 per hundredweight	305.55
To 3,756 pounds cottonseed meal, at $23.50 per ton	44.13
To 7,141 pounds corn-and-cob meal, at 70 cents per bushel	71.41
To 10,512 pounds cottonseed hulls, at $6.50 per ton	34.16
To 23,922 pounds corn silage, at $3 per ton	35.88
To 6,897 pounds alfalfa hay, at $15 per ton	51.73
To freight, yardage, commission, insurance, etc., 14 calves, at $2.175 per head	30.45
Total expenditures	573.31
By sale of 12 calves—7,600 pounds, at $7.25 per hundredweight	551.00
By sale of 2 calves—1,100 pounds, at $6.50 per hundredweight	72.15
Total by sale of 14 calves	623.15
Total profit on lot 3	49.84
Average profit per calf	3.56

The calves of lot 1 were finished somewhat better and a little more uniformly than those of either of the other lots. The calves of lots 2 and 3 showed lack of finish due to the small grain ration fed. This was reflected in the selling price of the animals, for all calves of lot 1 sold for $7.25 per hundred straight through, whereas there were two calves in each of the other lots which brought but $6.50 per 100 pounds, and all the others brought $7.25 per hundredweight.

Table 14 shows that no charge is made for the labor of feeding the calves, which was small, nor is any credit given the calves for the manure produced, nor for pork produced in lots 2 and 3. By this method the calves of lot 1 showed a net profit of $5.67 per head; those of lot 2, $2.98; and the ones of lot 3, $3.56 each.

When no pork credit is allowed for lots 2 and 3, and it would have been small because of the light corn ration, it is seen that the calves of lot 1 were more profitable than those of the other lots. This is partly due to the very cheap price of cottonseed meal at that time (due to the outbreak of the war) and the comparatively high price of corn charged on the farm where it was grown. It was estimated that the corn was produced at a cost not to exceed 40 cents per bushel, and if it had been sold it would not have brought the farmer more than 50 cents per bushel net, because of the distance from a shipping point, remoteness from market, and the bad condition of the roads over which it would have to have been handled.

When it is considered that by feeding the calves the corn, the corn silage and hay were sold through the calves at excellent prices, and more than that, a net cash profit was made, the results are considered very satisfactory.

SLAUGHTER DATA.

The calves were driven from the farm 6 miles to the loading pens. The shrinkage in transit was 36, 57, and 29 pounds for the calves of lots 1, 2, and 3, respectively. The heavier shrink of the calves of lot 2 is unaccounted for. The average shrinkage per head for all calves was 41 pounds. Although the calves of lot 2 made the largest daily gain, they had not fattened as well as either of the other lots, and this is reflected in the manner in which they dressed out. The calves of lot 1 sold for a little more per hundredweight and dressed out slightly higher than either of the other lots.

By farm weights the calves of lot 1 killed out nearly 2½ per cent more than those of lot 2 and 0.4 per cent more than those of lot 3. By market weights the calves of all three lots killed out very uniformly, lot 1 killing out a little better than either of the other two lots. The purchaser reported that all the calves killed out well and produced nice carcasses. The calves as a whole dressed out slightly over 54 per cent by sale weights.

TABLE 15.—*Slaughter data.*

Lot No.	Ration.	Average farm weight of each calf 4-12-15.	Average market weight of each calf 4-14-15.	Average shrink in transit.	Average weight of carcass.	Percentage dressed by farm weights.	Percentage dressed by market weights.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Per cent.*	*Per cent.*
1	Cottonseed meal Cottonseed hulls Corn silage Alfalfa hay	660	624	36	342	51.88	54.85
2	Cottonseed meal, two-thirds Corn-and-cob meal, one-third Cottonseed hulls Corn silage Alfalfa hay	668	611	57	330	49.40	54.05
3	Cottonseed meal, one-third Corn-and-cob meal, two-thirds Cottonseed hulls Corn silage Alfalfa hay	651	622	29	335	51.44	53.87

SUMMARY STATEMENT.

1. The object of this test was to get further information concerning the use of cottonseed meal and mixtures of cottonseed meal and corn for finishing calves for the market.

2. The average initial weights of the calves used in the test were as follows: Lot 1, 437; lot 2, 427; lot 3, 436 pounds. The final

weights were: Lot 1, 682; lot 2, 695; and lot 3, 663 pounds. The average daily gains per calf were: Lot 1, 1.71; lot 2, 1.87; and lot 3, 1.59 pounds.

3. All lots received corn silage, alfalfa hay, and cottonseed hulls as roughage. Lot 1 consumed 214 pounds of cottonseed meal for each 100 pounds gain. Lot 2 consumed 172 pounds of cottonseed meal and 86 pounds of corn-and-cob meal per 100 pounds gain. Lot 3 consumed 112 pounds cottonseed meal and 225 pounds of corn-and-cob meal for the same amount of gain.

4. The costs per 100 pounds of gain were as follows: Lot 1, $6.34; lot 2, $6.34; and lot 3, $7.40. The calves of all lots made gains very cheaply.

5. The amount of roughage required to make 100 pounds of gain was greatest with lot 1 and the smallest with lot 2.

6. The average profits per head for each of the lots were as follows: Lot 1, $5.67; lot 2, $2.98; and lot 3, $3.56.

7. The shrinkage of lots 1, 2, and 3 was 36, 57, and 29 pounds, respectively. The heavy shrinkage of lot 2 can not be explained.

8. By market weights the calves dressed out as follows: Lot 1, 54.85; lot 2, 54.05; lot 3, 53.87 per cent.

9. There were no pigs following the calves of lots 2 and 3. Under these conditions it did not pay as well to feed a mixture of cottonseed meal and corn-and-cob meal as it did to feed cottonseed meal as the sole concentrate.

IV. FATTENING CALVES ON COTTONSEED MEAL, CORN, CORN SILAGE, AND ALFALFA.

PLAN OF WORK.

The calf-feeding work for the winter of 1915–16 was conducted on the farm of Mr. Ben Walker near West Point, Miss., in the black-prairie section of the State. As the lots, shelter, and watering facilities have been described in connection with the previous year's work it is needless to repeat here. The only difference in conditions was that the calf pens were concreted during the summer months in order that the calves would not be forced to stand in the mud as they had during the latter part of the experiment of the previous year.

The calves were of about the same grade as those of the previous year, as half of them were raised on the farm and the other half bought from a neighboring farmer for 5 cents per pound. The majority of the calves were Shorthorns and Herefords, but a few Angus calves also were included. All the calves had run with their dams until about two weeks before the experiment started, when the purchased calves were weaned, dehorned, marked, and turned into an alfalfa field until the experiment was started. The home-raised calves were weaned, dehorned, and marked just a few days before the experiment was to start. All the calves had been dropped in the spring and were from 7 to 8 months old when weaned.

The calves were weighed individually on November 11, and again on the 12th, on which date they were divided into three similar lots and started on feed.

OBJECTS OF THE WORK.

In the Alabama experiments the calves were given small rations of grain for comparatively short periods. They made satisfactory gains and were in good killing order but were not well finished at the close of the tests. In this test it was decided to feed the calves for a longer period and to give them a heavier grain ration in order to have them well finished before they were sold.

The objects of this test were:

1. To see if good grade calves such as can be raised easily in Mississippi can be finished for the market economically and profitably.
2. To make a comparative study of the value of cottonseed meal alone, a combination of cottonseed meal and shelled corn, and shelled corn alone, as concentrated feeds to be used in finishing calves that were to be fed silage as the principal roughage, with a small amount of alfalfa hay.
3. To determine approximately how much manure could be saved by feeding calves on a concrete floor under shelter.

CHARACTER AND PRICES OF THE FEEDS USED.

As this test was a comparison of grain feeds, the same kind of roughage was fed to all three lots. Feeders generally have the impression that cattle which are being fattened will do somewhat better if they are given a small amount of some palatable hay when they are fed corn silage as the chief roughage. For this reason the calves of all lots were given about 4½ pounds of alfalfa hay per day in addition to all of the corn silage they would eat.

The cottonseed meal used was bright and of good quality, analyzing from 7½ to 8 per cent of ammonia. The corn was of good quality, being well matured and sound. The silage was of good quality, having been cut at the proper stage and carrying considerable grain. The corn probably would have yielded 45 bushels to the acre. The alfalfa was of rather low grade, as it had been damaged by heavy dews.

The feeds were charged at the following prices:

Cottonseed meal	per ton	$27.00
Corn	per bushel	.70
Corn silage	per ton	3.00
Alfalfa hay	do	15.00

AVERAGE DAILY RATIONS.

As all the calves were accustomed to alfalfa they were started on about 6 pounds of alfalfa hay and about 15 pounds of silage per day. The silage was increased rapidly as the calves became accustomed to it until at the end of two weeks they were given all they would clean up within one hour after feeding. As the calves were to be fed a long period they were started on a small amount of grain and this was very gradually increased until the fourth month after which they were given the maximum amount of grain until the close of the test.

It is a well-known fact that cattle to be fed for a long period will make almost as large gains and much more economical gains if they are fed a medium grain ration with all the good roughage they will eat for first part of the feeding period, and then given a heavy grain ration during the latter part of the period. This method was followed.

Table 16 shows the average amount of feed consumed daily by each of the calves in lots 1, 2, and 3 for each 28-day period they were fed.

TABLE 16.—*Average daily rations by 28-day periods, 1915–16.*

Lot No.	Ration.	First period.	Second period.	Third period.	Fourth period.	Fifth period.	Sixth period (16 days).	Average for entire of 156 days.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1	Cottonseed meal	2.2	2.7	3.5	4.3	5.0	5.0	3.69
	Corn silage	16.8	22.7	23.8	25.3	23.7	26.7	22.87
	Alfalfa hay	5.9	5.8	4.0	4.0	4.0	4.0	4.65
2	Cottonseed meal	1.00	1.2	1.3	1.6	2.0	2.0	1.49
	Shelled corn	4.1	4.8	5.4	6.6	8.0	8.0	6.01
	Corn silage	14.7	18.3	18.3	18.9	16.2	18.6	17.43
	Alfalfa hay	5.8	5.4	4.0	4.0	3.9	4.0	4.57
3	Shelled corn	6.0	7.1	8.1	9.7	11.1	12.2	8.78
	Corn silage	13.6	13.7	15.6	14.3	12.1	13.3	13.80
	Alfafla hay	5.5	5.6	4.0	4.0	3.6	4.0	4.49

During the first 28-day period each calf in lot 1 consumed 2.2 pounds of cottonseed meal, 2.7 pounds for the second period, and this amount was increased gradually as the feeding progressed until during the fifth and sixth periods the calves were on full feed, eating 5 pounds of cottonseed meal per head per day. The calves consumed 5.9 pounds of alfalfa and 16.8 pounds of corn silage per head per day the first period, but the hay was decreased after the second period to

4 pounds per head daily, and all of the corn silage was given that the calves would eat. This increased as the amount of hay was reduced, until during the last three periods each calf ate about 25 pounds of silage daily.

The concentrated feeds of the other two lots were increased in about the same manner. When the calves of lot 2 were on full feed they consumed 2 pounds of cottonseed meal and 8 pounds of shelled corn per head daily, whereas each calf in lot 3 received 12 pounds of shelled corn each day. The amount of silage consumed by the calves of lot 2 was about 7 pounds less than that consumed by the calves of lot 1. The calves of lot 3, which were fed on shelled corn alone as the concentrate, consumed but about half as much silage each day during the last two periods as the calves which were fed cottonseed meal. The amount of alfalfa hay was the same for all of the lots.

The last column of Table 16 shows the average amount of feed consumed daily by each calf for the entire feeding period of 156 days.

Table 17 shows the average initial weight, the average final weight, the average gain per calf, and average daily gain per calf for the entire feeding period.

TABLE 17.—*Total and daily gains (Nov. 12, 1915, to Apr. 16, 1916, 156 days).*

Lot No.	Ration.	Average initial weight per calf.	Average final weight per calf.	Average total gains per calf.	Average daily gains per calf.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
1	Cottonseed meal Corn silage Alfalfa hay	430	701	271	1.74
2	Cottonseed meal Shelled corn Corn silage Alfalfa hay	430	695	265	1.7
3	Shelled corn Corn silage Alfalfa hay	434	714	280	1.8

The average weights of the calves of the three lots were very uniform at the beginning of the test, being 430, 430, and 434 pounds for lots 1, 2, and 3, respectively. The average total gain per calf for the entire period was 271, 265, and 280 pounds, or a daily gain of 1.74, 1.70, and 1.80 pounds per head, respectively. These gains were very satisfactory for a long feeding period and they indicate that all the calves did well.

The calves of lot 1 were inclined to grow and did not fatten as rapidly as the calves of either of the other two lots. The calves of lot 3 were the fattest of the three lots, although there was not a great deal of difference between the calves of lots 2 and 3.

QUANTITY AND COST OF FEED TO MAKE 100 POUNDS OF GAIN.

The most important data in any feeding experiment are those relating to the daily ration, the rate of gain made by the animals, the amount of feed which is required to make 100 pounds of gain in weight, and the difference in selling price which results from the different methods of feeding. With these figures any prospective feeder can determine fairly accurately what feeds he had better use in fattening his cattle, how much he will need, and the gains he may expect; and knowing the cost of his cattle and feeds and about what the finished cattle will sell for he can approximate the profit or loss which may result from fattening his stock.

In the past farmers and stockmen have paid too little attention to these figures and laid too much stress upon the financial outcome of the special test to get the most good out of the experimental work.

Table 18 shows the amount of feed required to produce 100 pounds of gain in weight on the calves and also the comparative cost of 100 pounds of gain.

TABLE 18.—*Quantity and cost of feed required to make 100 pounds of gain, and selling price of calves (Nov. 12, 1915, to Apr. 12, 1916, 156 days).*

Lot No.	Ration.	Feed to make 100 pounds of gain.	Cost of 100 pounds gain.[1]	Selling price of calves per 100 pounds.
		Pounds.		
1	Cottonseed meal	213	$6.86	$8.17
	Corn silage	1,318		
	Alfalfa	268		
2	Cottonseed meal	88	9.05	8.58
	Shelled corn	353		
	Corn silage	1,025		
	Alfalfa hay	269		
3	Shelled corn	489	9.14	8.66
	Corn silage	769		
	Alfalfa hay	250		

[1] Prices of feeds used: Cottonseed meal, $27 per ton; corn, 70 cents per bushel; corn silage, $3 per ton; alfalfa hay, $15 per ton.

The calves in all three lots received the same kind of roughage, but ate varying amounts, dependent upon their appetites after consuming their grain. The daily gain of the calves in all lots was fairly uniform, but the amount of roughage consumed varied considerably. This variation is reflected in the amount of roughage required to make 100 pounds of gain.

The amount of feed required to make 100 pounds of gain is seen to be 213 pounds of cottonseed meal, 1,318 pounds of silage, and 268 pounds of alfalfa hay for lot 1; 88 pounds of cottonseed meal, 353 pounds of shelled corn, 1,025 pounds of silage, and 269 pounds of alfalfa for lot 2; and 489 pounds of shelled corn, 769 pounds of silage, and 250 pounds of alfalfa for lot 3.

The comparative cost of 100 pounds of gain for lots 1, 2, and 3 are $6.86, $9.05, and $9.14, respectively. The calves of lot 1 are seen to have required a very small amount of cottonseed meal and a comparatively large amount of cheap roughage to make 100 pounds of gain, while the opposite is true of the calves of lot 3, which received shelled corn as a concentrate. The calves of lot 3 required more than twice as much grain to make 100 pounds of gain, somewhat less alfalfa, and only a little more than half as much silage. This resulted in more expensive gains for the calves receiving corn. The amount of feed required to make 100 pounds of gain on the calves is considerably smaller than the amount required to put the same amount of gain on mature cattle. In fact it is seldom possible to make gains on any class of cattle in the dry lot, except calves, at a smaller cost than the selling price of the animals. This was done with the calves of lot 1.

The exclusive use of cottonseed meal as a concentrate for feeding calves has resulted invariably in good daily gains and very economical gains, but at the same time there has been a tendency for such calves to grow more and fatten less than is desirable while fattening. This has resulted in such calves selling for somewhat less than corn-fed calves, as shown in Table 18. The difference in selling price is often great enough almost to overcome the difference in the cost of production. There was a difference of 49 cents per 100 pounds in the selling price of the calves of lots 1 and 3 and a difference of 41 cents per hundredweight in the selling price of the calves of lots 1 and 2.

Strictly prime calves can not be made by feeding cottonseed meal as the sole concentrate, and though it is not always most profitable to put the maximum finish on calves it is usually more profitable to have them well finished than half fat. It is more frequently the case that extra finish on calves pays better than it does on steers of two years or older.

FINANCIAL STATEMENT.

Although any financial statement that is made is more or less unsatisfactory because there are so many variations from year to year in the prices of feeds, selling prices of animals, and margin of profit that the financial outcome may be reversed completely if any very radical change is made in any one of these factors, such a statement usually is desired by the reader and is of some value for comparative purposes.

One-half the calves used in this experiment were purchased for 5 cents a pound, pasture weights, without any shrink, so all the calves are charged in at that price. At this price the farmers made a profit raising them, as the cows were worth but about $45 each and the cost of wintering cows and pasturing them in that section of Mississippi is comparatively small. They were shipped to the St. Louis market, where they were sold. All the charges for shipping and selling are included in Table 19 with the other charges:

Table 19.—Financial Statement (Nov. 12, 1915, to Apr. 16, 1916, 156 days).

Lot 1. Cottonseed meal, corn silage, alfalfa hay:		
To 15 calves—6,450 pounds, at $5 per hundredweight		$322. 50
To 8,636½ pounds cottonseed meal, at $27 per ton	$116. 59	
To 53,522 pounds corn silage, at $3 per ton	80. 28	
To 10,890 pounds alfalfa hay, at $15 per ton	81. 68	
Total cost of feed		278. 55
To freight charges	29. 52	
To commission	7. 03	
To yardage, hay, etc	4. 83	
Total miscellaneous expenditures		41. 38
Total expenditures		$642. 43
By sale of 15 calves—9,790 pounds, at $8.168 per hundredweight		799. 65
Total net profit on lot 1		157. 22
Average net profit per calf		10. 48
Lot 2. Cottonseed meal, shelled corn, corn silage, alfalfa hay:		
To 14 calves—6,017½ pounds, at $5 per hundredweight		$300. 88
To 3,256 pounds cottonseed meal, at $27 per ton	$43. 96	
To 13,116 pounds shelled corn, at 70 cents per bushel	163. 95	
To 38,076 pounds corn silage, at $3 per ton	57. 11	
To 9,986 pounds alfalfa hay, at $15 per ton	74. 90	
Total cost of feed		339. 92
To freight charges	27. 55	
To commission	6. 56	
To yardage, hay, etc	4. 51	
Total miscellaneous expenditures		38. 62
Total expenditures		679. 42
By sale of 14 calves—9,320 pounds, at $8.578 per hundredweight		799. 35
Total net profit on lot 2		119. 93
Average net profit per calf		8. 57
Lot 3. Shelled corn, corn silage, alfalfa hay:		
To 15 calves—6,505 pounds, at $5 per hundredweight		$325. 25
To 20,547 pounds shelled corn (366.9 bushels), at 70 cents per bushel	$256. 84	
To 32,289 pounds corn silage, at $3 per ton	48. 43	
To 10,515 pounds alfalfa hay, at $15 per ton	78. 86	
Total cost of feed		384. 13

To freight charges	$29.52	
To commission	7.03	
To yardage, hay, etc	4.83	
Total miscellaneous expenditures		$41.38
Total expenditures		750.76
By sale of 15 calves—10,170 pounds, at $8.662 per hundredweight		880.93
Total net profit on lot 3		130.17
Average net profit per calf		8.68

In Table 19 no credit is given for the pork made by hogs following the calves of lots 2 and 3. Without considering this, exceedingly satisfactory profits were made on all the calves. The calves of lot 1 made a profit of $10.48 per head, those of lot 2 made $8.57 each, and the calves of lot 3 realized a net profit of $8.68, after paying the farmer an exceedingly good price for his corn, corn silage, and alfalfa hay.

Hogs were put in lots 2 and 3 to follow the calves, but owing to cholera breaking out on one part of the farm some of the fattest shoats were sold. Later some pigs and sows were permitted to follow the calves, but with existing conditions accurate records could not be kept of the gains made by them. It is estimated, however, that there should have been a pork credit of at least $3 per calf for each of the calves of lot 3.

If the pork credit had been but $2 per calf in lot 3, that would have meant that the calves that were fed a ration of shelled corn alone had paid the farmer 70 cents a bushel for the corn produced on the farm as well as market prices for all the roughage consumed, and in addition made as much profit as the calves that had been fed exclusively on cottonseed meal costing but $27 per ton. Furthermore it indicates that the diversified farmer of the South, with plenty of nutritious feeds, as silage, alfalfa, clover or cowpea hay, and corn, can finish out good calves without making cash expenditures for any purchased feeds. The farmer who does not have corn to feed but has good roughage, such as silage and hay, can feel sure that he can make good gains and economical gains by feeding cottonseed meal as the sole concentrate, but he can not get the calves quite as well finished, because of their tendency to grow when fed a heavy protein ration.

RECORD OF MANURE PRODUCED.

The calves were kept in pens having concrete floors under shelter, and the pens were scraped out daily and the manure weighed. No bedding was used, so there was some waste of liquid manure. Table 20 shows the amount of manure saved from the calves of each pen or lot:

TABLE 20.—*Manure yields (Nov. 12, 1915, to Apr. 16, 1916, 156 days).*

		Pounds.
Lot 1.	Total yield	68,235
	Average per calf	4,549
	Average per calf daily	29.16
Lot 2.	Total yield	60,090
	Average per calf	4,083
	Average per calf daily	26.17
Lot 3.	Total yield	49,830
	Average per calf	3,322
	Average per calf daily	21.29

It is seen that for the 156-day period there were saved from each calf in lot 1, 29.16 pounds of manure daily, while 26.17 pounds per head were saved from lot 2, and 21.29 pounds daily from each calf of lot 3.

No definite reason can be given for the calves of lot 1 producing more manure than those of the other lots. Can it be possible that the high protein ration caused the calves to drink more water, thereby causing more liquid manure to be voided? The fact remains that the average amount of manure produced per day by such calves was about 27 pounds per head.

SLAUGHTER DATA.

In shipping to the St. Louis market the calves were in transit 26 hours. The average net shrinkage per head was 48, 29, and 36 pounds for lots 1, 2, and 3, respectively, amounting to 6.8, 4.2, and 5.0 per cent of their live weights. The average shrinkage on calves of this weight in transit 26 hours usually ranges from 5 to 7½ per cent of their live weight. It is seen that the shrinkage here was a little less than average. The difference in shrinkage between the calves of the three lots can not be accounted for, as they were handled exactly alike. It is to be expected that the calves of lot 1 would shrink somewhat more than the other calves because they were not as fat and had been consuming a greater amount of roughage per day, but the difference was quite large.

TABLE 21.—*Slaughter data.*

Lot No.	Ration.	Average farm weight per calf 4-16-16.	Average market weight per calf 4-19-16.	Average shrinkage in transit.	Percentage of shrinkage.	Average weight of carcass.	Percentage dressed by farm weights.	Percentage dressed by market weights.[1]
		Pounds.	*Pounds.*	*Pounds.*	*Per cent.*	*Pounds.*	*Per cent.*	*Pounds.*
1	Cottonseed meal Corn silage Alfalfa hay	701	653	48	6.8	363	49.3	54.4
2	Cottonseed meal Shelled corn Corn silage Alfalfa hay	695	666	29	4.2	380	53.7	56.0
3	Shelled corn Corn silage Alfalfa hay	714	678	36	5.0	387	53.1	55.9

[1] Three calves, Nos. 22, 17, and 8, weighing 450, 500, and 480 pounds, respectively, were sold from lots 1, 2, and 3, as stockers. Thus slaughter data were obtained on the lots from 14, 13, and 14, calves, respectively. The farm weights of Nos. 22, 17, and 8 were 483, 520, and 515 pounds, respectively.

The carcasses of the calves of lot 1 did not show as much fat or finish as those of lots 2 and 3. No difference could be seen between the carcasses of lots 2 and 3, as they were well finished. By the farm weights the calves of lots 1, 2, and 3 dressed out 49.3, 53.7, and 53.1 per cent, respectively. By the market weights the calves of lot 1 dressed out 54.4 per cent; those of lot 2, 56 per cent; and the calves of lot 3, 55.9 per cent of their live weight.

SUMMARY STATEMENT.

1. The objects of this test were (1) to see if the feeding of heavy grain rations to calves until they were well finished would be profitable; (2) to make a comparative study of the value of cottonseed meal alone, a combination of cottonseed meal and shelled corn, and shelled corn alone, to be fed with a ration of silage with a small allowance of alfalfa hay; and (3) to determine approximately how much manure can be saved by feeding calves on a concrete floor.

2. The calves were good grade calves having from two to three crosses of beef blood on original scrub stock. They were from 6 to 8 months of age and weighed 271, 265, and 280 pounds for lots 1, 2, and 3, respectively, at weaning time, when the experiment began.

3. When on full feed the calves were eating the following ration per head per day:

		Pounds.
Lot 1.	Cottonseed meal	5. 0
	Corn silage	26. 7
	Alfalfa hay	4. 0
Lot 2.	Cottonseed meal	2. 0
	Shelled corn	8. 0
	Corn silage	18. 6
	Alfalfa	4. 0
Lot 3.	Shelled corn	12. 0
	Corn silage	13. 3
	Alfalfa	4. 0

The calves that consumed a heavy grain ration consumed a smaller grain ration and vice versa.

4. The calves were fed for 156 days and during that entire time made a daily gain of 1.74, 1.7, and 1.8 for lots 1, 2, and 3, respectively. This is a good gain for calves for a long feeding period.

5. The cost of making 100 pounds of gain for each of the three lots was $8.17, $8.58, and $8.66, respectively.

6. When no pork credit is allowed the calves of lots 2 and 3 the average profit per head was: Lot 1, $10.48; lot 2, $8.57; and lot 3, $8.68. It is estimated that the pork produced was worth about $3 per calf, which would make the corn feeding slightly more profitable than feeding cottonseed meal alone.

7. The calves of lots 1, 2, and 3 produced 29.2, 26.2, and 21.3 pounds of manure per head per day. No bedding was used and the manure was scraped up and weighed daily. Some of the liquid was lost.

8. During shipment the calves of lots 1, 2, and 3 shrank 48, 29, and 36 pounds, respectively, or 6.8, 4.2, and 5.0 per cent of their live weight.

9. The calves dressed out 54.4, 56.0, and 55.9 per cent of marketable meat. These percentages indicate that there was practically no difference in the fatness of the calves of lots 2 and 3, but both lots were much fatter than the calves of lot 1.

V. FATTENING LATE (SHORT-AGED) CALVES FOR MARKET.

HANDLING OF LATE CALVES.

In the foregoing parts of this bulletin are discussed various methods of fattening calves for the market during winter months. Experience has taught many feeders that a good growthy calf 6 months or more of age goes on feed and is fed much more satisfactorily than calves of a younger age. A calf 6 to 8 months old when put on feed does not seem to go off feed so easily as a younger calf, and as a result usually makes a larger and more uniform gain in weight from month to month than calves from 3 to 5 months of age.

In the South, where cattle usually are handled as a side line on the farm, the calves usually are dropped any time from January to August and some even later. Even on the good stock farms, where the time of breeding the cows is regulated as far as possible, it is seldom that all the calves are born during the early spring months; there are always some late or short-aged calves if the bull is kept with the cows until most of them get with calf.

How to handle these calves has long been a problem. When calves are selected for feeding purposes in the fall, the late ones always are cut back because of their age and size. Many of the younger ones are permitted to nurse their dams during the winter months, are weaned in the spring, and put on pasture to be grown out as yearlings or two-year-olds.

In the fall of 1915 there were a large number of such calves on the farm at Abbott, Miss., where the cooperative cattle-feeding work was being conducted jointly by the Bureau of Animal Industry and the Mississippi Agricultural College. It was decided to let these calves nurse their dams during the winter, maintaining the dams on a ration of coarse hay, silage, and a small amount of cottonseed meal, and then wean the calves in the spring and feed them out on pasture for the fall market. In case the calves would not become sufficiently fat and heavy on pasture, they were to be finished in the dry lot the following fall.

PLAN AND OBJECT OF THE WORK.

The objects of the work were as follows:

1. To determine if short-aged or late summer calves could be fed out or finished economically and profitably the following year.
2. To learn whether cottonseed cake or a mixture of cottonseed cake and shelled corn was most satisfactory and profitable as a grain ration for fattening calves on grass and in the dry lot.

The dams of the calves ran in the stalk fields and meadows of the plantation during most of the winter, but during the latter part they were fed some rough hay, silage, and a small amount of either cottonseed or cottonseed cake. The calves ran with their dams during this period and picked up some feed. They were from 6 to 8 months old in the spring when they were taken from their dams, weaned, divided into two lots as nearly equal in quality, breeding, and size as it was possible to get them, and put on pasture, where they were to be given a supplemental grain ration once a day.

The calves were principally grade Shorthorns and Red Polls, although a few calves of other breeding were among them.

Water was obtained from pools or ponds in the pasture, and these became very muddy and foul from the calves standing in them. This is the common method of watering cattle in the prairie region of Mississippi and Alabama.

CHARACTER AND PRICES OF FEEDS USED.

The two lots of calves were grazed on pastures as nearly uniform, with respect to the character of grasses, amount of grazing, character of soil and water, as it was possible to get. The pastures used were native unimproved prairie pastures with some relatively unimportant native grasses and Lespedeza or Japan clover growing on them. The Lespedeza furnished the principal grazing, although there was some crab grass and foxtail which was grazed to a certain extent. The pastures had many bare places where no plants grew. Good improved pastures could be made on such land by plowing, disking, and planting to good grasses and legumes, but in their native state they were relatively poor prairie pastures. About 4 acres were allowed for each calf.

The summer of 1916 was an unusually droughty one, and as a result the pastures were poor and short all summer. There was no rain on the pastures from July 25 to October 30, and as a result the calves had to be taken off pasture on October 31 and put in the feed lot because of scarcity of water and shortness of grass.

The cottonseed cake which was fed while the calves were on pasture contained about 38 per cent protein and was bright in color. It was a medium grade of cake. The corn was good sound corn, free from weevils. Cottonseed cake cost $30.50 per ton, and corn was valued at 80 cents per bushel. Pasture was charged at the rate of 50 cents per head for each 28-day period.

METHODS OF FEEDING AND HANDLING THE CALVES.

The calves were fed once each day, between 5 and 6 o'clock in the afternoon. They were numbered by means of metal tags on neck straps. The cottonseed cake and the mixture of one-third cottonseed cake and two-thirds shelled corn were fed in troughs located at a convenient place in each pasture. Salt was given the calves once a week.

The calves of lot 1 were started on 1 pound of cottonseed cake per day and this amount gradually increased until at the end of the second 28-day period they were eating 3 pounds per day, and at the end of the third period they were eating 4½ pounds per head per day. They were fed this amount for the rest of the summer.

The calves of lot 2 were started on one-half pound of cottonseed meal and 1 pound of corn per head daily. This was increased gradually until at the end of the second period they were eating 1 pound of cottonseed meal and 2 pounds of corn. By the end of the third 28-day period they were eating 3 pounds of cottonseed meal and 6 pounds of shelled corn per head daily. This amount was fed until the end of the grazing season, October 30, 1916.

Each of the calves was weighed individually three days in succession at the beginning of the experiment and the average taken as the initial weight. Each lot of calves was weighed each 28 days thereafter as a whole, and individual weights again were taken at the end of the grazing season.

RESULTS OF THE SUMMER FEEDING.

Table 23 shows the results of the calf feeding for the entire summer period, May 5 to October 30, 1916, inclusive.

There were 25 calves in each lot at the beginning of the experiment, but one calf in lot 2 died of blackleg, leaving but 24 in that lot. The calves of each lot were fed from May 5 to October 30, inclusive, or 179 days. The average weight of the calves of lot 1 on May 5 was 333 pounds and the average weight of those of lot 2 was 340 pounds. During the summer each calf in lot 1 gained 252 pounds and each calf in lot 2 gained 293 pounds. The average daily gain of lots 1 and 2 was 1.41 and 1.63 pounds per head, respectively.

These gains seem rather small for calves that were fed as liberally as these, but when the exceedingly droughty summer with the resulting poor pastures is considered the calves did very well. The calves of lot 2, which were fed a heavier grain ration than those of lot 1, made the larger gains.

TABLE 23.—*Calf feeding during the summer of 1916 (May 5 to Oct. 30, 179 days).*

Item.	Lot 1: pasture and cottonseed cake.	Lot 2: pasture and one-third cottonseed cake; two-thirds shelled corn.
Number of calves	25	24
Length of feeding period...days	179	179
Average initial weight of calves, May 5...pounds	333	340
Average final weight of calves, October 30...do	585	633
Average total gain per head...do	252	293
Average daily gain per head...do	1.41	1.63
Amount of feed required to make 100 pounds of gain: Cottonseed cake...pounds	247	126
Amount of feed required to make 100 pounds of gain: Shelled corn...do	....	250
Cost of making 100 pounds gain, pasture included	$5.04	$6.58
Cost of calves per hundredweight, May 5	5.00	5.00
Cost of calves per head, May 5	16.65	17.00
Cost of feed per head for entire summer	9.50	16.08
Cost of pasture per head for entire summer	3.20	3.20
Total cost per calf on Oct. 30, 1916	29.37	36.27
Average cost per hundredweight in fall, October 30	5.02	5.73

It is seen that the calves of lot 1 required 247 pounds of cottonseed cake in addition to grass to make 100 pounds of gain in weight, and the calves of lot 2 required 126 pounds of cottonseed cake and 250 pounds of shelled corn for producing 100 pounds of gain in weight. When the feeds are charged at market prices and pasture at 50 cents per head for each 28-day period it cost $5.04 and $6.58 to make 100 pounds of gain in live weight on the calves of lots 1 and 2, respectively.

The calves were valued at 5 cents a pound on May 5, when the experiment began, the cost per head at that time being $16.65 for lot 1 and $17 for lot 2. The cost of the concentrate fed during the summer was $9.50 per calf for lot 1 and $16.08 per head for lot 2. There was a pasturage charge of $3.20 per head for the calves of each lot for the summer. The total cost per calf in the fall of the year (October 30, 1916) was $29.37 for lot 1 and $36.27 for lot 2. The average cost per hundredweight in the fall was $5.02 for the calves of lot 1 and $5.73 for the calves of lot 2.

At this time the calves of lot 2 were in much better shape than those of lot 1, but the calves of each lot had been growing considerably and were not well enough finished to be marketed at this time. As they were not fat enough for market on October 30 and the grass was very short, it was decided to put the calves in the dry lot and feed them corn silage for roughage and continue the grain ration the same as when the calves were on pasture until they were finished.

METHOD OF HANDLING THE CALVES.

The calves were weighed up on October 30 and transferred to the barn, where they were started on feed October 31, 1916. The calves of each lot were fed in pens in a large barn which was open enough on the sides and ends so there was plenty of ventilation at all times. The pens were concreted, so the calves were not in the mud. Fresh water from a deep well was kept before the calves at all times. The silage was fed in troughs and the grain ration mixed with it. The silage was of good quality and was eaten readily by the calves. Feeding was done at 7 a. m. and 3.30 p. m. each day. The calves were weighed each 28 days while on feed.

AVERAGE DAILY RATIONS.

Table 24 shows the daily rations per calf by 28-day periods

TABLE 24.—*Average daily rations by 28-day periods (Oct. 31, 1916, to Jan. 5, 1917, 67 days).*

Lot No.	Number of calves.	Ration.	First period.	Second period.	Third period (11 days).	Total amount of feed eaten per head.	Average daily ration for entire period.
			Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1	25	Cottonseed meal	4.5	4.5	4.5	299	4.5
		Corn silage	35.8	37.8	37.5	2,460	37.0
2	24	Cottonseed meal	3.0	3.0	3.0	199	3.0
		Shelled corn	6.0	6.0	6.0	399	6.0
		Corn silage	27.6	30.3	30.0	1,938	29.1

During the first 28 days of the feeding period the calves of lot 1 consumed 35.8 pounds of silage per head per day, and those of lot 2 consumed 27.6 pounds.

The grain ration for each calf of lot 1 was 4.5 pounds of cottonseed meal per day for the entire period, and each calf in lot 2 was fed 3 pounds of cottonseed meal and 6 pounds of corn daily.

For the remainder of the feeding period, the calves of lot 1 ate about 37.5 pounds of silage per head per day, and those of lot 2 about 30 pounds each. The average daily ration for the entire period was 4.5 pounds of cottonseed meal and 37 pounds of silage for lot 1, and 3 pounds cottonseed meal, 6 pounds shelled corn, and 29.1 pounds of silage for lot 2.

TOTAL AND DAILY GAINS.

The total and the daily gains made by each calf are shown in table 25.

At the beginning of the winter feeding the calves of lot 1 averaged 585 pounds in weight. During the 67 days the calves were on feed the calves of lot 1 receiving cottonseed meal gained 100 pounds each, or an average daily gain per calf of 1.49 pounds. The calves of lot 2, averaging 633 pounds, gained 102 pounds, or 1.52 pounds per head per day. These gains were not large, but it must be remembered that the calves had been on feed some time before being put in dry lot. They fattened much more rapidly than the gains would indicate, and at the end of the feeding period were quite fat.

TABLE 25.—*Total and daily gains (Oct. 31, 1916, to Jan. 5, 1917, 67 days).*

Lot No.	Number of calves.	Ration.	Average initial weight per head.	Average final weight per head.	Total average gain per head.	Average daily gain per head.
			Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
1	25	Cottonseed meal Silage	585	685	100	1.49
2	24	Cottonseed meal Shelled corn Corn silage	633	735	102	1.52

AMOUNT AND COST OF FEED REQUIRED TO MAKE 100 POUNDS OF GAIN.

Table 26 shows the total gain, the total amount of feed consumed per calf, the amount of feed required to make 100 pounds of gain, and the cost of 100 pounds of gain with feeds charged at market prices.

TABLE 26.—*Amount and cost of feed required to produce 100 pounds of gain (Oct. 31, 1916, to Jan. 5, 1917, 67 days).*

Lot No.	Number of calves.	Ration.	Total amount of feed eaten per head.	Average total gains per head.	Feed required to make 100 pounds of gain.	Cost of feed to make 100 pounds of gain.
			Pounds.	*Pounds.*	*Pounds.*	
1	25	Cottonseed meal	299	100	299	$9.82
		Silage	2,460		2,460	
2	24	Cottonseed meal	199	102	195.1	12.44
		Shelled corn	399		391.1	
		Silage	1,938		1,900	

Prices of feeds used:

Cottonseed meal	per ton	$41.00
Shelled corn	per bushel	.80
Corn silage	per ton	3.00

The calves of lot 1 consumed 299 pounds of cottonseed meal and 2,460 pounds of silage for each 100 pounds of gain in weight, while those of lot 2 consumed 195 pounds of cottonseed meal, 391 pounds of corn, and 1,900 pounds of silage to make the same amount of gain. Each 100 pounds of gain cost $9.82 and $12.44 for lots 1 and 2, respectively. The calves receiving cottonseed meal as the sole concentrate consumed 560 pounds more silage for each 100 pounds of gain in weight, but they consumed so much less concentrated ration that the gains cost almost 3 cents a pound less.

SLAUGHTER DATA.

The calves were driven from the farm at Abbott to West Point, Miss., and from there they were shipped to the St. Louis market. They were in transit 25 hours, and shrank 41 and 47 pounds per head for lots 1 and 2, respectively.

TABLE 27.—*Slaughter data (May 5, 1916, to January 5, 1917, 246 days).*

Lot No.	Number of calves.	Average final farm weight per head.	Average market weight per head.	Average shrinkage en route to market.	Shrinkage en route to market.	Average price paid per hundredweight.	Average weight of carcass.[1]	Per cent dressed—	
								By farm weight.	By market weight.
		Pounds.	*Pounds.*	*Pounds.*	*Per cent.*		*Pounds.*	*Per cent.*	*Per cent.*
1	25	685	644	41	5.9	$8.05	340	49.6	52.8
2	24	735	692	47	6.4	8.47	379	51.5	54.7

[1] Farm weights less 2 per cent shrinkage.

The calves of lot 1 sold for $8.05 per hundredweight, and those of lot 2 sold for $8.47 per hundred pounds. The calves of lot 1 dressed out 52.8 per cent and those of lot 2 dressed out 54.7 per cent by market weights. The corn-fed calves were fatter than the cottonseed-meal calves at the end of the feeding test, and this was reflected in the dressing percentage.

FINANCIAL STATEMENT.

The financial outcome of this experiment was very satisfactory. The calves cost or were valued at $5 per hundredweight in the spring. Cottonseed cake in the summer cost $30.50 per ton, and the cottonseed meal in the winter cost $41.50 per ton. Corn silage was charged at $3 per ton, and pasture was charged in at 50 cents per calf per 28-day period.

Table 28 shows the financial outcome of the feeding of both lots of calves:

TABLE 28.—*Financial statement.*

Lot 1:	
To purchase 25 calves—8,325 pounds, at $5 per hundredweight	$416.25
To 15,575 pounds cottonseed cake, at $30.50 per ton	237.52
To pasture, 179 days, at 50 cents per head per 28 days, 25 calves	79.91
To 7,475 pounds cottonseed meal, at $41 per ton	153.24
To 61,500 pounds corn silage, at $3 per ton	92.25
To freight charges to market	43.75
To commission, $15; yardage and feed, $8.25	23.25
Total expenditures	1,046.17
By sale of 25 calves—16,100 pounds, at $8.05	1,296.05
Total profit	249.88
Average profit per calf	10.00

Lot 2:

To purchase 24 calves—8,170 pounds, at $5 per hundredweight	$408.50
To 8,856 pounds cottonseed cake, at $30.50 per ton	135.05
To 17,568 pounds shelled corn, at 80 cents per bushel	250.97
To pasture, 24 calves, 179 days, at 50 cents each per 28 days	76.71
To 4,776 pounds cottonseed meal, at $41 per ton	97.91
To 9,576 pounds shelled corn, at 80 cents per bushel	136.80
To 46,512 pounds silage, at $3 per ton	69.77
To freight charges to market, 24 calves	42.00
To commission, $14.40; yardage and feeds, $7.92	22.32
Total expenditures	1,240.03
By sale of 24 calves—16,600 pounds, at $8.48 per hundredweight	1,407.68
By pork credit for hogs following calves	63.63
Total	1,471.31
Total profit on 24 calves	231.28
Average profit per calf	9.64

There were eight shoats which followed the calves of lot 2 while in the feeding lot from November 7, 1916, to January 5, 1917, or 60 days. These shoats got no feed other than what they picked up behind the calves. They cost 7½ cents per pound in the fall when they were put in the feed lot. While they followed the calves they gained 470 pounds in weight, or almost 1 pound per head per day. The hogs sold for 10 cents a pound, making a total profit of $63.63.

After the calves paid for all the feeds consumed at market prices, paid for the pasture at the rate of 50 cents per head per 28-day periods, and paid for themselves at the prevailing price in the spring and given a credit for pork produced they returned a profit of $10 a head when fed as lot 1 and $9.64 when fed as lot 2. If the shoats had cost 10 cents per pound and sold for 10 cents per pound they still would have returned a profit of $47; and when the calves are given the credit for this amount of pork they produced, the profit per calf would have been $8.91 per head instead of the actual profit of $9.64 which was realized.

DISCUSSION OF RESULTS.

This experiment indicates that it is possible to handle the "short-aged" calves, which always occur to a certain extent in all herds, in such a manner as to realize a nice profit on them. As the calves are too young to give satisfactory and profitable results by giving a short feed in the fall and winter, it is a good plan to let them nurse the cows during the winter while maintaining the cows and calves in fair condition in an economical manner, weaning the calves when grass becomes good in the spring, and feeding them on grass during the summer. In case they did not become fat enough for the market while on grass or if the market was weak and unsatisfactory they could be finished in the feed lot for the Christmas market or for a later market if desirable.

Cottonseed meal proved a very satisfactory concentrated ration for the calves while on grass and also when being fed silage during the winter. There was a greater tendency for the cottonseed-meal-fed calves to grow instead of fattening than was the case with the calves fed on shelled corn supplemented with cottonseed meal. The cottonseed-meal-fed calves made satisfactory and economical gains when the kind and condition of pasture were considered, as the summer of 1916 was a most unfavorable one in the prairie of Mississippi for fattening cattle on grass.

The experiment indicates also that where corn can not be marketed readily it can be fed to calves very satisfactorily and at a good return. The corn-fed calves made better although more expensive gains than the calves fed on cottonseed meal alone. If the profits on the hogs and the increased selling price of the calves are taken into consideration, the corn-fed calves made almost as much profit as the others.

If all the feeds except corn are charged at market prices and the profit is considered, the value of the corn fed to the calves gave a return of $1.57 per bushel for every bushel of corn consumed. It is seen, therefore, that the feeding of corn would have been exceedingly profitable to the man who could not have sold his corn in any other way and would have been much more profitable to market it in this way if a good market had been accessible.

Should the farmer who can sell his corn readily and purchase cottonseed meal for feeding sell his corn or feed it? To answer this question let us see at what price he would have to charge his corn to the calves in order to make as much profit as the cottonseed-meal-fed calves made. In this experiment, if the shelled corn had been charged at 77 cents per bushel, the calves of each lot would have made the same profit, namely, $10 per head. If corn could not have been sold for enough over 77 cents per bushel for preparing it for market and marketing, it would have been much more profitable to feed it to calves than to sell it. This test indicates clearly that with good calves corn can be fed at a profit even though it is worth a high price. The better the calves, the more expensive corn can be fed without danger of loss. With scrub or cheap cattle the southern farmer can not afford to use high-priced corn.

In these experiments no charge has been made for labor, nor any credit given for the manure produced. The value of the manure will overbalance the cost of feeding, so that there is an indirect profit in calf-feeding which has not been included or discussed in the results.

This experiment indicates that while cattle are high-priced and good pastures can be obtained for grazing purposes, the problem of what to do with short-aged or late calves may be solved very profitably by handling in the same manner tried out in this test.

SUMMARY.

1. Short-aged calves that are too young to wean and put on feed in the fall can be fed grain while on pasture the following summer and sold directly off grass or finished in the dry lot.

2. During both the summer and the winter feeding periods the calves that were fed shelled corn and cottonseed meal made larger but more expensive gains than those fed on cottonseed meal as the sole concentrate.

3. Gains made during the summer are very much cheaper than those made in the dry lot during the winter.

4. The grain ration of the calves of lot 1 cost $9.50 and that for lot 2, $16.08 for the summer.

5. The calves cost $5 per 100 pounds in the spring and the cost in the fall after all feed and pasture was charged against them was $5.02 and $5.73 per hundredweight for lots 1 and 2, respectively.

6. When on full feed, each calf of lot 1 ate 4½ pounds of cottonseed cake per day; and of lot 2, 3 pounds cottonseed cake and 6 pounds of shelled corn.

7. The calves were fed 179 days on pasture and 67 days in the dry lot, or a total of 246 days.

8. The calves of lot 2, which received shelled corn, were much fatter than those of lot 1 when finished and they dressed out 2 per cent more. They also sold for 43 cents more per hundredweight.

9. Eight pigs following the calves of lot 2 made one pound per head per day gain and returned a pork credit per calf of $2.65.

10. When the pork credit is considered the calves fed corn returned almost the same profit as the calves fed cottonseed meal.

11. For each calf of lot 2 to make the same profit as lot 1, namely, $10 per head, the corn had to be charged at 77 cents per bushel instead of 80 cents.

VI. GENERAL DISCUSSION OF THE FIVE YEARS' EXPERIMENTS.

The prices of the feeds and cattle used varied so much from year to year that the financial statements of the various experiments are not strictly comparable. If cottonseed meal was very cheap one year and comparatively high another year, the financial outcome of the two experiments would be misleading. This is true of all similar experiments, and for this reason experimental data can not be used directly by a feeder where conditions are different from those reported in the experiment.

If the farmer is given certain data as to the average daily gains, the amount of feed required to make 100 pounds of gain, and if he knows what his cattle and feed cost, he can figure out very closely how much profit he can make out of steer feeding if he receives 1½, 2, 2½, or 3 cents margin or spread on cattle. The data mentioned are given in each of the experiments reported in this bulletin, and can, therefore, be used by anyone familiar with figuring out profits on cattle feeding.

To put the work reported in this bulletin on a more comparable basis and to bring it more up to date some tabulations have been prepared which show the amount of feed required to make 100 pounds of gain, the cost of 100 pounds of gain, and the profit realized per calf in each experiment, if they had been sold at various margins. All calves are charged in at the average price of 6½ cents per pound on the farm, and the average price of all of the feeds for the years 1915 and 1916 are used.

The Bureau of Crop Estimates furnished the following prices on various feeds. These are the average for good quality for the years of 1915 and 1916.

Cottonseed meal	per ton	$36.00
Cottonseed cake	do	36.00
Shelled corn	per bushel	.86
Corn-and-cob meal	per ton	26.00
Cottonseed hulls	do	14.00
Mixed alfalfa hay	do	16.00
Corn silage	do	3.50
Corn stover	do	8.00
Cowpea hay	do	15.00
Oat straw	do	8.00

The prices of feed used in the calculation of Table 29 were as follows:

Cottonseed meal	per ton	36.00
Corn	per bushel	.86
Corn-and-cob meal	do	26.00
Corn chop	do	32.00
Cottonseed hulls	do	14.00
Corn silage	do	3.50
Alfalfa hay	do	18.00
Mixed alfalfa hay	do	16.00

Pasture 50 cents per head for 28-day period.

If these prices for the feeds are used the cost of 100 pounds of gain for the calves of lot 1 ranged from $7.89 in 1911–12 to $9.77 in 1912–13.

The cost of 100 pounds of gain for the corn-fed calves of lot 2 ranged from $8.68 to $9.65 per 100 pounds, or somewhat higher than for the cottonseed-meal-fed calves.

The calves of lot 3, which were fed a heavy corn ration, made still more expensive gains, the cost of each 100 pounds of gain ranging from $7.77 to $11.13.

TABLE 29.—*Amount of feed consumed per hundred pounds gain and cost per hundred pounds gain.*

Station and year.	Ration.	Lot 1.	Lot 2.	Lot 3.
Alabama, 1911–12	Feed per hundredweight gain:			
	Cottonseed meal ... pounds	134	115	77
	Corn-and-cob meal ... do	....	58	154
	Cottonseed hulls ... do	528	566	602
	Mixed alfalfa hay ... do	222	238	255
	Cost per hundredweight gain	$7.89	$8.68	$9.64
Alabama, 1912–13	Feed per hundredweight gain:			
	Cottonseed meal ... pounds	175	144	176
	Corn chop ... do	....	72	....
	Cottonseed hulls ... do	946	536	438
	Corn silage ... do	....	1,084	875
	Cost per hundredweight gain	$9.77	$9.39	$7.77
Abbott, Miss., 1914–15	Feed per hundredweight gain:			
	Cottonseed meal ... pounds	214	172	112
	Corn-and-cob meal ... do	....	86	225
	Cottonseed hulls ... do	346	309	331
	Corn silage ... do	774	690	753
	Alfalfa hay ... do	207	191	217
	Cost per hundredweight gain	$9.48	$9.31	$10.33
Abbott, Miss., 1915–16	Feed per hundredweight gain:			
	Cottonseed meal ... pounds	213	88	....
	Shelled corn ... do	....	353	489
	Corn silage ... do	1,318	1,025	769
	Alfalfa hay ... do	268	269	250
	Cost per hundredweight gain	$8.55	$9.65	$11.13
Abbott, Miss., 1916–17:				
Summer	Feed per hundredweight gain:			
	Cottonseed cake ... pounds	247	126	....
	Shelled corn ... do	....	250	....
	Pasture ... do	....	....	....
	Cost per hundredweight gain	$5.04	$6.58	....
Winter	Feed per hundredweight gain:			
	Cottonseed meal ... pounds	299	195	....
	Shelled corn ... do	....	391	....
	Corn silage ... do	2,460	1,900	....
	Cost per hundredweight gain	$9.68	$12.86	....

The calf-feeding work of 1916–17 shows most clearly the value of pasture supplemented with a grain ration for fattening calves. The cottonseed-meal-fed calves of lot 1 made 100 pounds of gain in the summer for $5.04, whereas in the winter the same gain in weight cost $9.68. When one-third cottonseed meal and two-thirds shelled corn were fed as the grain ration the calves of lot 2 made gains during the summer at $6.58 and during the winter at $12.86 per 100 pounds.

In Table 30 no account is taken of the pork that would be produced behind the calves receiving corn, and this amount must be calculated and added to the profits for the corn-fed calves. There would be no pork credit for the calves of lot 1, fed cottonseed meal, and a smaller credit for those fed corn-and-cob meal than the ones fed shelled corn or broken ear corn. At the present prices of pork, it would be conservative to add a pork credit of $2 to $3.50 per calf for the calves of lots 2 and 3 for the last three years, depending upon the amount of corn fed to each lot. This amount of profit should be added to the profit shown in the table.

In Table 29 it is seen that in every year except 1912–13 where corn was fed the cost of the gains was more than where cottonseed meal was fed as the sole concentrate.

The profit per calf as shown in Table 30 is computed on the basis of a spread or margin of selling over purchase price of 1½, 2, 2¼ and 2½ cents per pound.

TABLE 30.—*Profit realized per calf if they sell for 1½, 2, 2¼, and 2½ cents above cost price of 6½ cents per pound.*[1]

Station and year.	Sold at margin of—	Profit per calf.		
		Lot 1.	Lot 2.	Lot 3.
	Cents.			
Alabama, 1911-12	1½	$5.80	$4.37	$2.88
	2	8.75	7.17	5.48
	2¼	10.24	8.58	6.97
	2½	11.65	9.98	8.33
Alabama, 1912-13	1½	2.99	4.52	5.50
	2	5.52	7.06	7.97
	2¼	6.78	8.33	9.21
	2½	8.04	9.60	10.45
Aboott, Miss., 1914-15	1½	−3.89	−5.99	−4.92
	2	−.76	−2.11	−1.81
	2¼	.79	−1.41	−.24
	2½	2.35	.11	1.29
Abbott, Miss., 1915-16	1½	3.98	−2.90	−7.81
	2	7.24	.42	−4.43
	2¼	8.87	2.08	−2.73
	2½	10.50	3.74	−1.04
Abbott, Miss., 1916-17	1½	6.11	−4.12	....
	2	9.33	−.66	....
	2¼	10 94	1.07	....
	2½	12.55	2.79	....

[1] No credit has been given in the table for the pork produced.

Table 30 shows that when the average price of feeds for the last two years is taken as a standard, the calves that were fed cottonseed meal as the sole concentrate would have made a nice profit every year, except one, on a margin of 1½ cents per pound.

During the years 1911-12 and 1912-13, when ear corn ground into corn-and-cob meal was fed in very small quantities a bigger profit was shown on a margin of 1½ cents than where corn was fed in larger amounts daily. The work of each of the first two years is strictly comparable with each other, and the work of each of the last three years is also comparable, but as light corn rations were fed the first two years and heavy ones the last three years, the two groups of years are not comparable with each other. In the work of the last three years, where a medium to heavy grain ration was fed, there would be naturally a larger pork credit per calf, otherwise the heavy corn feeding would have been very unprofitable.

The calves that were fed corn liberally made more rapid gains than calves fed on cottonseed meal alone and fattened much faster, as there was a tendency for the calves that were fed cottonseed meal as the sole concentrate to grow instead of fattening. The corn-fed calves also sold somewhat higher because they were fatter; but though prime calves could not be made when cottonseed meal was fed as the sole concentrate, it was usually more economical and more profitable to feed cottonseed meal alone than to feed a combination of cottonseed meal and corn or a ration of corn alone. This is owing to the comparative cheapness of cottonseed meal with corn when the feeding value of the two concentrates is considered. As long as cottonseed meal remains cheap and corn relatively high in price the results probably will be the same. There are some exceptions to this, however. On farms where considerable corn is raised and can be marketed only at considerable expense, the farmer can get a good price for the corn by feeding it to his calves and hogs. The higher the quality of the calves the less danger of loss there is in feeding more expensive corn. Calves of high quality usually pay better returns for the feed consumed than scrub calves.

When corn was fed liberally the calves invariably finished out better than the cottonseed-meal-fed calves and usually made larger daily gains. They usually sold for somewhat more per hundredweight and killed out a higher percentage of dressed meat.

Although prime calves could not be made by feeding cottonseed meal as the sole concentrate, the calves became fat enough and made gains cheap enough to sell well and return a good profit year after year. While cottonseed meal continues relatively cheap, good profits can be made by feeding it to fattening calves.

Corn silage proved a much more satisfactory roughage for fattening calves than cottonseed hulls.

The calves made a profit every year when feeds were charged in at cost; but in some cases the profit was small, as the value of the manure has not been considered in writing up these tests.

GENERAL CONCLUSIONS FOR THE FIVE YEARS' CALF FEEDING.

The calf-feeding work reported in this bulletin covers a period of five years. The calves used in all of the experiments were very similar in age, size, breeding, and quality. Those fed during the first four years of the experimental work reported in this bulletin were fed in a very similar manner, as the general conditions under which the feeding was done were very similar. The calves averaged from six to eight months of age in the fall when they were put on feed.

In all five years' work there has been a comparison of the value of cottonseed meal and a combination of cottonseed meal and corn for fattening calves for the market. In some cases the corn was fed as corn-and-cob meal, in others as corn chop, and in still others as shelled corn, but the comparison of cottonseed meal and corn has remained throughout.

The roughage used during one year was not the same as that used another year, but each year the roughage was exactly the same for the lots which were being compared.

In the first two tests, where corn was substituted for cottonseed meal, the substitution was made pound for pound and the results were unsatisfactory, because a pound of corn has a much smaller feeding value than a pound of cottonseed meal; and the corn-fed calves therefore were getting a smaller amount of digestible nutrients and consequently did not do as well as the cottonseed-meal-fed calves. During the later experiments, where corn was substituted for cottonseed meal, the substitution was made in about the proportion of 2 pounds of corn for 1 pound of cottonseed meal.

The use of corn invariably increased the cost of the gains made, regardless of the kind and amount of roughage used. Where corn was fed very sparingly as a substitute for cottonseed meal, the amount or size of the daily gains of the calves was not increased; but where corn was fed liberally the calves made larger daily gains than the calves fed on cottonseed meal alone. The increased gains were not great enough, however, to overbalance or offset the increased cost of the gains, so the cottonseed-meal-fed calves were usually a little more profitable.

Unless the calves that were fed corn were followed by shoats to utilize the waste grain, the feeding of corn was not as profitable as the use of cottonseed meal as the sole concentrate.

In the South, during the last three years, there has often been a margin of 2 to 3 cents a pound between purchase price of calves at weaning time and selling price in the spring. Under such conditions, with the current prices of feedstuffs, the feeding of calves for the market has been very profitable.

The work of 1916–17 indicates that calves too young to wean and fatten for market in the fall can be made to pay a nice profit by letting them nurse the cows during the winter, feeding them grain on grass the following summer, and selling them in the fall, or by following the summer feeding with a short feeding in the dry lot and selling about Christmas or soon after.

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